Estimating the Economic Opportunity Cost of Capital for Kenya

Roksana Ghanbariamin

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Prof. Dr. Serhan Çiftçioğlu
Acting Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Economics.

Prof. Dr. Mehmet Balcılar
Chair, Department of Economics

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Economics.

Prof. Dr. Glenn Paul Jenkins
Supervisor

Examining Committee

1. Prof. Dr. Glen Paul Jenkins

2. Asst. Prof. Dr. Hasan Ulaş Altıok

3. Asst. Prof. Dr. Kemal Bağzıbağlı

ABSTRACT

The social or economic discount rate is used to estimate the net present value -NPV- of an investment. This process is for recognizing the worthwhile projects among all the available choices, so only those with a higher positive NPV will be implemented. What rate to be used as this discount rate, and its size has been always an issue among economists. One of the most reliable approaches is based on the fact that the source of funds is borrowing from the capital market; therefore the economic cost of capital is an appropriate value to be considered as the discount rate. This value can be measured by calculating the funds sourced from the capital market, and estimating the economic opportunity cost for these funds. In this thesis developing a general framework for the estimations of economic opportunity cost of capital -EOCK- is the objective. The reason to estimate this value is for using it as the discount rate in investment decisions for Kenya.

Methodologically, the funds obtained from the capital market are ultimately sourced from three places, postponed or displaced investments, postponed or forgone consumption, and inflows of foreign sources. The first step in getting EOCK is to obtain the economic cost of funds from each of these three sources, and the second step is to calculate the weighted average of these three values.

The results show that the estimated discount rate ranges from 10% to 14.5% in real terms. As a conclusion, a 12% real discount rate is an appropriate rate for Kenya to be used in project evaluation, and investment decision making.

Keywords: economic opportunity cost of capital, discount rate, project evaluation, Kenya

ÖZ

Sosyal veya ekonomik iskonto oranı bir yatırımın net mevcut değerini ölçmede kullanılır. Bu süreç yapılmaya değer projelerin fark edilmesine olanak sağlayıp yüksek net mevcut değere sahip projelerin uygulanmasını sağlamaktadır. Uygulanacak olan iskonto oranı ve bunun büyüklüğü ekonomistler için her daim önem arz eden bir soru olmuştur. Bu konuyla alakalı en çok kullanılan ve güvenilir olarak kabul edilen yaklaşımsermaye piyasasından fon olarak alınan borçlardır; bu yüzden sermayenin ekonomik maliyeti iskonto oranı olarak kabul etmek için uygun bir değer olarak karşımıza çıkmaktadır. Bu değeri ölçmek için de sermaye piyasasındaki borç fonların tamamı ve ekonomik fırsat maliyeti hesaplanmalıdır. Bu tezde de genel bir çerçeve ekonomik fırsat maliyetinin ölçülmesi için oluşturulmaya çalışılmıştır. Ekonomik fırsat maliyetini ölçmekteki amacımız ise iskonto oranı olarak onu Kenya için yatırım kararlarında kullanmaktır.

Yöntem açısından sermaye piyasasındaki fonlar üç farklı kaynak aracılığıyla tedarik edilmiştir. Bu kaynaklar sırasıyla ertelenmiş ya da yeri değiştirilmiş yatırımlar, ertelenmiş ya da feragat edilmiş tüketimler, ülkeye doğru akan dış yatırımlardır. Sermayenin ekonomik fırsat maliyetini ölçmenin ilk basamağı her üç kaynaktaki fonları elde etmek ve ikinci aşamada ise ağırlıklı ortalama değerlerini hesaplamaktır.

Çalışmanın sonuçları iskonto oranının yüzde 10 ile yüzde 14.5 arasında değiştiğini göstermektedir. Sonuç olarak yüzde 12 oranındaki reel iskonto oranının Kenya için proje değerlendirmede ve yatırım kararlarını vermede uygun olacağı görüşüne ulaşılmıştır.

Anahtar Sözcükler: sermayenin ekonomik fırsat maliyeti, iskonto oranı, proje değerlendirilmesi, Kenya

To my mother,

who has been the greatest inspiration of my life.

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Finally, I am solely responsible for any possible errors or omissions within this thesis.

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Chapter 1

INTRODUCTION

The Republic of Kenya is located in an area is East Africa called the African Great Lakes region. Nairobi is Kenya's capital and also its largest city. According to the last census of July 2012, this country has a population of approximately 44 million. Kenya's economy is market-based, consisting of a few numbers of state-owned infrastructure enterprises. Also a liberalized external trade system has been used in controlling its economy. Kenya has been generally perceived as Africa's centre for financial activities, Communication and Transportation services. Kenya has experienced a great growth in terms of economic progress with 4% average annual growth rate of the real gross domestic product –GDP-, which is caused mainly because of expansions in industries such as tourism, telecommunications, transport, construction in addition to agricultural recovery programs. This rate of growth attracted an outstanding amount of foreign and domestic investment. The gross fixed capital formation (GFCF) increased annually 12.37% on average; this contains land improvement, machinery, plant, equipment purchases, construction of railways and roads, and building hospitals, schools, commercial and industrial buildings, and offices.[1] On the other hand, the value of foreign direct investment (FDI) attracted to Kenya, was above 100 million US dollars in 2008-9, despite the 2008 Great Recession.

[1] World Bank

Given the scarce amount of resources available in such countries, project evaluation is an important and crucial factor in allocation of the limited resources into their most productive uses.

This is why I was encouraged to create an analytical and general framework for calculating the economic opportunity cost of capital for Kenya in this thesis. This rate would be used in economical appraisal of projects, both in public and private sector, thus obtaining an appropriate estimation of this national parameter is necessary and vital for practical use in each country. The way it works is to discount the economic benefits and costs of an investment project over its life for determining its present value. The goal of this project evaluation is to protect good projects from being rejected while stopping bad ones from being implemented.

Funds for investment will be raised mainly from different sectors of a country based on the response caused by variation of the interest rates because of borrowings which are mainly from the capital market. Therefore, for a country with such an economy where the marginal source of funds is the capital market, the appropriate way to estimate the economic cost of capital is by considering the economic opportunity cost of funds which the capital market has provided from: First, investments on other projects may be postponed or displaced, because of the required cost for undertaking the project. Second, some funds will be sourced by the postponed or forgone consumption in order to increase the domestic savings to get the net of tax return, so that an additional consumption can be financed later. Third, funds are sourced from abroad; this is from additional foreign inflows of foreign sources.

As a result economic opportunity cost of capital will be estimated by finding the economic cost of funds which are obtained from these following sources; the rate of return on displaced or postponed investment (π), the social cost of new domestic savings (γ), and the marginal cost of foreign capital inflows (MC_f), and calculating the weighted average of these three values. Which can be shown as,

$$EOCK = f_1 \bullet \pi + f_2 \bullet \gamma + f_3 \bullet MC_f \qquad \text{Equation 1}$$

The weights (f_1, f_2, f_3) are equal to the proportion of funds diverted or sourced from each of the domestic sectors of private investors and private savers, and the foreign savers sector. The appropriate way to measure them is by changing the market interest rates by applying increases in government borrowing and checking the reaction of this change on savers and investors. So they can be estimated using the supply and demand elasticity of funds with respect to changes in the cost of financing, and obviously $f_1 + f_2 + f_3$ is equal to one.

This thesis consists of 5 chapters. Chapter two contains a brief literature review of the debate over the appropriate rate of return and the most appropriate one to use. In chapter three, we show the methodology of how to estimate the real rate of return to reproducible capital investment using national accounts data, and the important factors which should be taken into account in this calculation. Then we explain how to estimate the recent stimulated domestic savings' cost, and the cost caused by an additional foreign capital inflow. Finally, we discuss the methodology of estimating the economic opportunity cost of capital using these three main sources of funds obtained from the capital market. In chapter four, an empirical estimation of the EOCK for Kenya has been done; given the methodology explained in chapter 3, and

the assembled data from the national accounts of this country. Finally, conclusion is presented in chapter five of this study.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

Investment projects usually last for many years, therefore it is important to choose which project is worthwhile to be undertaken, and in such appraisals the net present value (NPV) criteria has proved to be the most satisfactory criterion. This criterion discounts the economic costs and benefits generated by projects, and it chooses the one with the highest positive NPV. The calculation of NPV requires a discount rate. Unfortunately there has been so much controversy over the choice of a proper discount rate in economic cost-benefit analysis for the past 50 years. When we are defining this term as "the economic or social discount rate" actually we are considering the viewpoint of society from the time value of the costs and benefits, but having an accurate estimation of this parameter is fundamental and can be much more complex. Finding a proper discount rate for evaluating investment projects both in public and private sector has been a matter of debate for over 50 years. Economic theorists pointed out three different approaches on this issue; the first approach is that the discount rate should reflect the social (or economic) opportunity cost of capital.[2] The second view suggests that the discount rate should reflect the

[2] Harberger (1969) Sandmo and Dreze (1971)

value in term of the social rate of time preference[3], and the third approach is to consider the marginal cost of funds as the discount rate[4].

2.2 The SOC Criterion

This criterion first was proposed by Harberger (1969) and confirmed by Sandmo and Dreze (1971). Based on this criterion the forgone rate of return in the private sector should be reflected in an appropriate social discount rate, when the capital market is the source of funding in projects. In a closed economy, the sources of funding would come from consumption or investment. If there are any distortions such as taxes, this will cause a gap between the rate of return to an additional capital to those who own the capital and the marginal value of the product of capital. As we can see in equation (2) below, the social discount rate can be calculated by adding the marginal rate of time preference (consumption rate of interest r) multiplied by its weight which is the proportion of consumption (1- α), and the marginal value of the product of investment in new capital (ρ) multiplied by the proportion of funding drawn from investment (α), in other words we can calculate this weighted average using the following formula:

$$SDR = (1-\alpha)\, r + \alpha\, \rho = w \qquad \text{Equation 2}$$

ρ = the marginal rate of productivity of capital

r = the consumption rate of interest

α = the proportion of funding that comes at the expense of investment

In an open economy another component which is the foreign savings should be added to the financial resources. When this is the case, the value of the cost of foreign funding, which is the marginal cost of foreign funding, should be added to

[3] Eckstein (1957), Marglin (1963) Feldstein (1972), and Bradford (1975).
[4] Liu (2003), Liu et. al. (2004)

the calculation of the social discount rate, and this property is considered totally flexible only in Harberger's opportunity cost approach.

Another advantage of this method is that it needs no extra classification of costs and benefits, and no adjustment on investment expenditures.

That is what makes the social discount rate a unique and common view to all projects which are undertaken in an economy. This is the most straightforward way of determining the discount rate.

2.3 The Shadow Price Algorithm

The second criterion is the shadow price algorithm. This criterion was first proposed by Eckstein (1957), and Marglin (1963) has refined it, and it was extended later by Feldstein (1972), and Bradford (1975).

They believe that the combination of two distinct prices into one discount rate in the weighted average discount rate causes an aggregation error. These errors can be caused by considering the price of future consumption in current consumption terms and the price of investment in terms of consumption. They suggest that a better way to evaluate a project is to convert its constant dollar values of benefits and costs into "consumption equivalents" using the shadow pricing method for all the investment displaced or induced by the project. The second step would be discounting these values at the social rate of time preference, or STP rate. In other words, the STP rate estimates a rate in which individuals are willing to trade their present consumption with their future consumption.

According to this method a worthwhile project satisfies the following condition.

$\Sigma [(1-\beta + \beta SPC) Bt-(1-\alpha + \alpha SPC) Ct]/ (1+r) t >0$ Equation 3

β = proportion of a dollar's worth of benefits that are saved

α = proportion of a dollar's worth of costs that displace investment

SPC = the shadow price of capital (the present value of consumption that a dollar of private investment would generate, discounting at the STP rate.)

Bt = project's benefits in period t

Ct = project's costs in period t

Choosing the shadow price method might create two difficulties in determining the worthiness of the public investment.

The first problem is that, since this rate is the result of a positive effect which is the private capital formed by public investment and a negative effect of displacing private projects; this opposite rates can cause different effects of public investment depending on the project's type, the length of the project, and the way it is financed. Therefore, this can result in more than one discount rate for projects.

The second problem is that in this method there should be absolute clarification between items which are investment and those that represent consumption. This distinction is difficult to make, because mainly the analyst will face a stream of costs and benefits. But in the SPC approach, the analyst should make two major adjustments on investment, first is a conversion factor to translate financial into economic values, and shadow price for capital to translate the economic values of income into economic values of consumption. Sjaastad and Wisecarver (1977) show that the shadow price algorithm and the SOC criterion both produce an identical

result given that the project has an initial cost that generates a perpetual stream of benefits. The assumption in their calculation is that the project's benefits are treated as income and they are fully anticipated. But the important insight in their calculation was that the shadow price of public funds and its magnitude is not dependent on how the money is spent. Hence, if this methodology is followed this shadow price should be applied to both current expenditure as well as investment outlays.

These problems made this method difficult to apply, it created an extensive debate in the economic literature.

2.4 The MCF Criterion

The marginal cost of funds (MCF) criterion has been proposed recently by Liu (2003) and Liu, Rettenmaier, and saving (2004). MCF is an extension to a multi-period context of the static welfare criterion in a tax-distorted economy. Therefore, for a project with benefits B_0 and costs C_0 happening in the same time, the project is worthwhile when $B_0 > MCF. C_0$, where *MCF* is the cost induced by raising an additional dollar of funds to finance the project.

If we generalize this criterion to a multi-period projects with deferred costs and not fully consumed benefits, the MCF criterion becomes

$$\Sigma Bt/ (1+r) t - MCF \Sigma [Ct-IRt]/ (1+\rho) t \qquad \text{Equation 4}$$

The condition for a project to be worthwhile to be undertaken is that its present value of benefits discounted at the STP rate should exceed the cost of raising an additional dollar of funds to finance the project multiplied by the project's expenditure requirements discounted at the SOC rate.

Liu (2003) argues that both SOC and SPC approaches suffer from implementation problems. The SOC criterion is flawed since it discounts benefits at a high rate (ρ rather than r), because it does not consider indirect revenue effects, and it also assumes that the cost of an additional fund is unity for a lump sum tax. On the other hand, the shadow price algorithm is also flawed since it discounts costs at a low rate because its measurement of the consumption equivalent value of project costs is not correct. The MCF criterion considers that the funding of a project by government must be obtained by increasing lump sum taxes. And when government increases taxes, part of this tax increase reduces saving and capital income tax revenue in next periods, thus a dollar rise in lump sum taxes will increase less than a dollar of tax revenue.

He further argues that the main problem with SOC is that the MCF parameter is not considered into account in calculating the SOC criterion. He also mentions that in determining the necessary weights for the approximation of the social opportunity cost of capital, no general formula has been found yet, so each project needs its own specific, appropriate rate of discount which makes the SOC and SPC criteria almost impossible to use in practice. Consequently the appropriate discount rate which avoids these problems is the MCF criterion, which has a project independent discount rate for evaluating benefits, costs, and the MCF parameter.

Burgess (2013) attempts to reconcile the SOC and MCF criteria for evaluating projects in a tax-distorted economy. He compares these two criteria in 3 different situations; with lump sum taxation, with distortionary taxation, and in a case where the rate of return is given as an exogenous factor. He shows that the "project specific" problem of SOC will be solved, in case we follow Harberger (1969) which

defines the SOC rate as the social opportunity cost of borrowed funds. In his comparison he finds that both SOC and MCF criteria work properly in identifying all worthwhile projects, when the lump-sum tax system is used for marginal tax instrument, and an exogenous pre-tax rate of return is used. However, in special situations each criterion may have an advantage to the other one. As an example the SOC criterion has an implementation advantage to MCF, when project's benefit is treated as income, because in this situation there is no indirect revenue to be considered in the calculation. On the other hand in a situation where the benefit is treated as separable from private consumption, it's better to use the MCF criteria. He also states that even the SOC criteria considers the lump-sum tax system for the marginal tax instrument, it does not mean that in a situation where lump-sum taxes data are not available, the MCF criteria has an advantage compared to the SOC, because the SOC rate can be easily adjusted in such situations. Also Liu's MCF criterion only works in a situation when there is an exogenous pre-tax rate of return. Therefore Burgess way generates a modified version of MCF which works in a situation with endogenous rate of return. The key factor to be considered though is that the SOC criterion is calculating the project's impact on the budget of government, whereas the MCF criterion evaluates the impact of project on private surplus, and when a project satisfies one of the criterions it will for sure satisfies the other one.

Moore et al. (2013) suggests that the social time preference (STP) method is still a better way of estimating the discount rate. They add that the fundamental goal of the STP method is to maximize the utility (happiness), which depend on the per capita consumption both in present time and future consisting of all goods and services,

both in private and public sector. They believe that the estimation of discount rates which are done using the SOC method are so high, and this results in misallocation of resources over appropriate funding in projects. They also believe that even by using the SOC method, and recalculating the previous rates correctly, a lower discount rate will be gained.

They further argue that many analysts prefer the STP method over the SOC. The reason for that are two main differences between these two criterions. The first difference is that taxes are treated as the ultimate funding source for projects in the STP method, whereas projects are debt-financed in the SOC, and since governments try to make decisions about their debt level before engaging themselves in choosing a project, the STP method is more realistic. The second difference is that in the STP method the comparison is between effects on the social welfare in a project which is financed by taxes and the counterfactual of having no project (without any increase in taxes). On the other hand, in the SOC criteria governments are assumed to increase a specific amount of taxes, and then decide in either using them in paying for the project or reducing the debt of government, which does not seem like a sensible assumption in evaluating government projects.

Burgess and Zerbe (2013) completely disagree with Moore opinion. They believe that the best discount rate is the SOC in evaluating projects, because by adopting this method the best alternative with the highest rate of return will be chosen for sure, since SOC's first rule is that the project with a higher return has priority to the other ones, and it also guarantees that the worthwhile project will satisfy the potential Pareto test. Whereas the STP method introduced by Moore et al. cannot satisfy either of these conditions. They add that underestimating the discount rate does not

solve environmental concerns, but a correct estimation of willingness to pay can better address this problem.

They further argue that the differences by which Moore introduced STP as a better discount rate are conceptually flawed. First of all, the SOC's assumption which is the marginal source of fund is the capital market, reflects the fact that this method considers the impact of project on the budget of government keeping the private sector at its current utility (pre-project). If a project manages to improve the government revenue (discounted at the SOC rate) and to keep the private sector pre-project situation, that would be a worthwhile project to be undertaken. Secondly, in a situation where "Ricardian Equivalence" holds the private sector can recognize that whether or not a project is financed by an increase in the tax rate, will not affect the project's worthiness. But even if RE does not hold, as Moore et al believe, and the case of being debt financed or tax financed fools the public choice, considering what is the use of that scarce tax dollar, on projects or on paying down debts, is still very important and necessary. As a result the SOC method is the one which works whether RE holds or not.

Moore et al. (2013) later confirm that the choice of an appropriate discount rate is not an easy task, and since there is no testable data in either of the methods, it is not possible to check for empirical falsification. In this situation, the choice for a suitable method largely depends on what the source of funding in public investment project is. If government is planning to increase private consumption at the current time, and to lower taxes the STP method will fit better. On the other hand, if the condition is increasing current private consumption, while lowering government debt and interest rate the SOC method is a better fit.

Harberger and Jenkins (2015) divides the STP rated to a "social fiat" rate of time preference and a time preference rate linked to economic growth. He believes that a discount rate which is derived from society's decision not only has no possible justification, but also has no roots in traditional economic analysis, so it's not a reliable approach for determining the discount rate. On the other hand, he proves that a time preference rate linked to economic growth is made based on a flawed assumption of constant utility function. Therefore, the STP method is not an appropriate way to be used in government project evaluations.

Harberger suggests that the "standard" approach that he refers to has a strong root in economic analysis, and it first evolved in a context of a closed economy model, which is the SOC method. He also suggests that the data source which is better to be used in this method is better to be national accounts data, because it captures the whole GDP, and all the returns to capital, so it gives a robust result. But if we base our estimation on financial market data, we face many problems such as volatility of the market, limited data, and obtaining a negative rate for having data in real term. He further argues that with this source of data and three adjustments on monopoly profit, real cost reduction, and subtracting GDP attributes to land, SOC method is the most appropriate way to be used in determining an appropriate discount rate in project evaluations.

Using Harberger's SOC method, we try to estimate the economic opportunity cost of capital (EOCK) for Kenya in the following chapters.

Chapter 3

METHODOLOGY OF ESTIMATING THE ECONOMIC OPPORTUNITY COST OF CAPITAL FOR KENYA

3.1 Analytical Framework

Creating an analytical framework in order to calculate the economic opportunity cost of capital to be used in project evaluations in Kenya is the main purpose of this chapter. The estimation of this national parameter is vital for practical use in appraisal of investments economically both in public and private sectors of a country. It is used to discount the economic benefits of a project during its life, and also costs of an investment in that lifetime in order to determine the present value of the project. Considering this value in the decision making process, helps to have a productive allocation of investment.

Funds for investment will be raised mainly from different sectors of a country based on their response from changes in interest rates because of source of borrowing which is the capital market[5]. The funds obtained from the capital market are ultimately sourced from three places. First, investments on other projects may be postponed or displaced, because of the required cost for undertaking the project. Second, some funds will be sourced by the postponed or forgone consumption in order to increase the domestic savings to get the net of tax return, so that an additional consumption can be financed later. Third, funds are sourced from abroad; this is from additional foreign inflows of foreign sources.

[5] Kuo et al. (2003)

EOCK can be estimated by using a weighted average measure including three sources. These three sources are the return rate of the investment that has been displaced or postponed (π), the social cost that we encounter when we use new domestic savings (γ), and the marginal cost which is caused by foreign capital inflows (MC_f). Equation 1 shows the relationship among these factors.

The proportion of funds diverted from each sector will be used as the weights (f_1, f_2, and f_3), in which f_1 is the weight for the domestic private investors sector, f_2 is the weight of the domestic private savers' sector, and f_3 is the foreign savers' weight. The appropriate way to measure them is by considering the reaction in the behavior of savers and investors which is caused by a small change in the market interest rates happening from a raise in government borrowing, and obviously $f_1 + f_2 + f_3$ is equal to one.

3.2 Real Rate of Return to Reproducible Capital Investment

The main goal of this section is to show how we can get the value of the real rate of return to domestic investment made on reproducible capital assets in Kenya. There are various approaches to estimate this return. This thesis considers the ratio of the total amount of national income which is directly attributed to this component of the capital stock in a specific year to the reproducible capital's stock at the beginning of that year containing buildings, machinery, and equipment, both in units of the same purchasing power[6]. The best method for estimation of the returns to reproducible capital relies on the national accounts data, because rent, interest, and profit incomes, which are the components of the return on capital, are recorded there. Furthermore, to have the complete range of economic activities nothing works better

[6] This method of estimation of return to capital in form of reproducible capital was first developed by Harberger and Wisecarver (1978) for Uruguay for the period of 1967 to 1971.

than the national accounts data in each country. Therefore, it will allow us to specify both the stock of reproducible capital, and the flow of income generated by that capital. Unfortunately the detailed breakdown of the components of the national accounts varies widely across countries.

Since the necessary data for an accurate estimation differs from country to country, and there are often gaps in the necessary information, it is necessary to use other sources based on the country in question. Also some adjustments should be done, because the data is not available in a straightforward way. The starting point is the GDP of the country excluding and including some factors based on the country's economic activities. We take other countries' estimation of the parameter of economic opportunity cost of capital as an example to clarify the different steps and adjustments needed in this part.

In this section the aim is to discuss each of the factors which should be taken into account when we want to calculate the income that is directly attributed to capital. In section 3.1.1 we review the method to deduct the value of land's income from GDP, in part 3.1.2 the deduction of land attributes to capital will be discussed. Then in section 3.1.3 and 3.1.4 taxes, subsidies, and national resources will be taken into account respectively. Finally in section 3.1.5 we show how the calculation of capital stock is made and the real rate of return to domestic investments is estimated.

3.2.1 Labor's Contribution to GNP

Labor income has a contribution to the GDP of each economy. To calculate this value we should find the summation of all the wages and salaries that are paid by corporations and unincorporated businesses. There are usually wide ranges of data on corporation's wages and salaries, but in most countries which use the United

Nation's system of national accounts; data on unincorporated labor content is not available. On the other hand, unincorporated enterprises are mainly small farm operations and businesses. In this kind of farms what we encounter is that usually the owner of the farm is also a worker, and also in some cases their family members are working there as labors too. What happens in this situation is that usually they are not getting paid formally with wages. Thus, this sector's income is mainly made of labor earnings, and the remainder shows returns on their investments. As a result, the returns to both labor and capital must be considered as the operating surplus of this sector.

To our knowledge, however, the data are not available for Kenya. Thus, in order to determine this value, an assumption must be made on the share of unincorporated wages and salaries, based on the size of that sector and also these wages relative contribution to the share of reproducible capital in that economy. Another factor which might be helpful is the value of GDP per capita, because countries with the same level of GDP per capita tend to have the same contribution of labor to GDP. The share of labor in GDP has been estimated for different countries with similar situations, for South Africa the share of labor in GDP varied between 38-41% during the periods 1992-96[7]. However, there is considerable empirical evidence that for countries with a lower value of GDP per capita, the contribution of labor to GDP is lower. Hence, a lower contribution rate should be considered for Kenya, compared to South Africa. A reasonable estimation of the contribution of labor in Kenya is about 35% of GDP. Later we conduct a sensitivity analysis on this component to check the effect of a change in this component in our estimation.

[7] Kuo et al. (2003)

Finally, this labor income should be deducted from GDP to calculate the income that was an attribution of capital, which will be discussed further in the next chapter.

3.2.2 Land's contribution to GNP

Land counts as a fixed factor in production which also has a contribution to GDP; and since the aim is to estimate the reproducible capital share, it is necessary to exclude the value added from land which is attributable to the unimproved land, because the national accounts' focus is on the flow coming from consumption, production, and investment of a good or service in a given period. Under this concept, when there is an improvement in land, such as improvements by clearing, installation of infrastructural utilities, fencing, canals, leveling, irrigation, and drainage, it is the country's investment in land and we should consider it as a part of the reproducible capital. Therefore, if we consider the total capital stock, and we estimate the proportion of unimproved land in this value we can observe that it is a small value, and the process of estimating this value is the most difficult task.

To make it simpler, it is better to consider the agricultural and housing sector, which are the best and the most important sources of calculating the value added by land. The data on gross value added by agriculture (GVA) has been published by World Bank by Kenya, but what is available is a combination of agricultural sectors which consists of sub-sectors of forestry, fishing and livestock, so according to the GDP statistics published by KNBS, the share of crop agriculture in the aggregate sector ranges from 87-89%. The next step is to calculate the contribution of land to GDP, which is set equal to 33% of the total value added of the agricultural sector.

On the other hand, information for estimating the value added by land and the contribution of land in the housing sector is not available for Kenya. Thus, no adjustment has been made for this sector.

3.2.3 Taxes and Subsidies

As it was mentioned earlier the aim is to estimate the rate of return to reproducible capital, this return should be gross of taxes but net of depreciation, because taxes and subsidies produced by labor and capital are also a part of the GDP.

Taxes on products such as property taxes, corporate income taxes, share of sales and excise taxes also attribute to the value added of reproducible capital. But there are some adjustments that should be undertaken. Taxes on products is born both by labor and capital, in order to account for the return to reproducible capital the share that is born by labor should be deducted from GDP.

Also when the value-added tax is a consumption type, vendors can claim tax credits in each stage of production and distribution. This is because there is tax burden that they carry on their business inputs, and they want to recover this burden, because the tax is on the sales of goods and services in all stages. Therefore, the value-added tax is borne by labor and it is not a part of the value added of capital, and this value has to be taken out from the GDP to estimate the amount of return on reproducible capital alone.

Subsidies on the other hand, must be added to GDP for the aim of getting the return to capital. For this purpose, only subsidies on products need to be estimated. After estimating this value, given the relationship between Gross Value Added (GVA) and GDP, i.e. GDP=GVA + taxes on products – subsidies on products, a share of

subsidies which is born by capital must be added to GDP to estimate the value added to capital.

3.2.4 National Resource Rents

In the past, mining has formed a major part of GDP in developing countries. This income was mostly from non-renewable resources like diamonds, platinum, gold, and coal. These resources can produce a substantial economic resource rent with the help of reproducible capital. Even though this component is not significant in most developed countries nowadays, it can be important in several developing counties. It is worthwhile to mention that getting the income to reproducible capital requires the subtraction of resource rents from the income to capital.

For the case of Kenya, the data is not available for the national resource rent. Also based on the data from countries with similar situation, this component has a small share, so we have not account for that factor in our analysis.

3.2.5 Stock of Reproducible Capital

The procedure explained in part 3.1.1 to 3.1.4 provides the estimate of the amount of income which can be attributed directly to the capital. However what we are interested in is to estimate the rate of return to capital. To do so, deflating the income to capital with the GDP deflator is the first step, and then finding the capital stock data in values of the same price level.

The database of Penn World Table (PWT) version 8 provides the measures of reproducible capital stock for Kenya using the perpetual inventory method (PIM). PIM depends on investments in six assets, transport equipment, structures, communication equipment, computers, software, and other machinery and assets, adding to the national gross fixed capital formation (GFCF). The sum of private and

public GFCF, total GFCF, which includes the construction of schools, roads, and the public buildings, must be excluded from the capital stock data which was estimated in the PWT, because it is a non-remunerative share of public investment. The reason to do that is because the reproducible capital's average return in remunerative investment is the real return to what is invested domestically. The next step would be to reduce the value of capital stock associated with the general government administration, such as national defense and public security, from the total estimated value of reproducible capital. The reason is that the government borrowing in the capital market won't affect the investment in these operations, and the income generated from them is not included in the measurement of GDP by national accounts, thus we should remove them from the estimation of reproducible capital. These two together have a value close to 50% of the capital stock estimated in PWT for Kenya.

However, investments sourced from public-sector enterprises which operate as business firms should be included in the stock of reproducible capital. A reasonable estimation of this value for Kenya is 15% of the aggregate fixed capital stock. So overall the series of reproducible capital we use in our estimation is 65% of the reproducible capital stock data published in PWT for Kenya.

The final step is to estimate the real rate of return from the remunerative reproducible capital stock, by estimating the ratio of the total amount of national income which is directly attributed to capital in a specific year to the stock of reproducible capital. This calculation should be done at the beginning of that year, and both values should be in units of the same price level. For the purpose of

calculation the EOCK, the average rate of return will be used as the value of real rate of return to domestic investment (π).

3.3 The Social Cost of New Domestic Savings

When an increase in project fund happens in the capital market of a country, domestic savings tend to increase. For the supply of new savings, consumers need to reduce their consumption and this will have an opportunity cost of forgone or postponed consumption on consumers which is stimulated by an increase in the demand of funds required for financing the investment projects.

In order to estimate the social cost of new domestic savings, one should consider the net-of-tax income of individuals, who are the source of generating the newly stimulated domestic savings. So the point to start from is the gross-of-tax income to reproducible capital, then the value of personal income taxes should be subtracted from that value. To do so taxes that are paid by individuals on the amount of income they gained from their investments and the share of income and property taxes that is paid by corporations should be taken into account.

In addition to that, financial institutions like banks have some financial intermediation services and there will be costs associated with these services. Therefore, in order to obtain what savers will see as the return from their savings, we should deduct these services cost from the net-of-tax income to capital. These costs are an economic resource cost which creates a difference between the return to investment and the interest rate which is charged to borrowers, and if there was no additional saving, there would be no additional intermediation cost. So, the real rate of return to domestic saving is what is obtained in this step, which must be deflated

by the GDP deflator. Later this value should be divided by the number we have for the reproducible capital stock of remunerative administrations to obtain the average real rate of return to savings, which is equal to the opportunity cost of forgone consumption as a result of an increase in savings. This rate can be used as the social cost of new domestic savings (γ), for estimating the EOCK purpose.

3.4 Marginal Economic Cost of Foreign Capital Inflows

Another result of an increase in project funds in the capital market of a country is the capital inflows from foreign countries, because resources available for investment not only increase by domestic savers, but also by savings of foreigners. So an increase in the demand for investible funds also encourages foreign residents to consume less and save more. For the purpose of attracting funds for a capital market, governments tend to increase the interest rate and this will cause an additional cost when foreign borrowing is involved, because this interest rate which is larger will be charged both on the incremental borrowing and on all the other variable interest rate debt of prior and current. As a result, the cost which should be considered in our calculation would be the marginal cost of borrowing.

We can calculate this marginal cost by considering the foreign financing of an additional unit's cost plus the additional financial burden on all the other borrowings caused by the market interest rate. As a result, as the share of capital stock of a country causing from raises in the foreign investment, the marginal cost of the additional foreign borrowing will also increase. This marginal cost of foreign borrowing can be calculated as follow:

$$MC_f = r_f \bullet (1 - t_f) \bullet \left[1 + k \bullet \left(1 / \varepsilon_f \right) \right] \qquad \text{Equation 5}$$

In which r_f is foreign loan's interest rate by the project, t_f is the withholding tax rate on charged on interest payments by foreigners, k is the ratio of the total foreign financing whose interest rate is floating to the total amount of foreign capital inflows, and ε_f is the elasticity of supply of foreign funds with respect to the interest rate.

Considering that there might be an expected foreign inflation rate, equation (5) can be rewritten as below:

$$MC_f = \left[\frac{i_f \bullet (1 - t_f) - gP^f}{1 + gP^f}\right] \bullet \left[1 + k \bullet \left(1/\varepsilon_f\right)\right] \qquad \text{Equation 6}$$

In which gP^f is the inflation rate measured as the GDP deflator and i_f is the nominal interest rate of the foreign country. By gathering data on each component of this formula, we can estimate the marginal cost of foreign funds for EOCK estimation.

3.5 Weights of the Three Diverted Funds

Estimating the weights of each of the three diverted funds would be the next step on the calculation of EOCK. These weights depend on the initial share of their sources and their price responsiveness to the market interest rates. Thus, we can express them in terms of elasticities of supply and demand as follow:

$$F_1 = \frac{-\eta\left(\frac{I_t}{S_t}\right)}{\varepsilon_h\left(\frac{S_h}{S_t}\right) + \varepsilon_f\left(\frac{S_f}{S_t}\right) - \eta\left(\frac{I_t}{S_t}\right)} \qquad \text{Equation 7}$$

$$F_2 = \frac{\varepsilon_h\left(\frac{S_h}{S_t}\right)}{\varepsilon_h\left(\frac{S_h}{S_t}\right) + \varepsilon_f\left(\frac{S_f}{S_t}\right) - \eta\left(\frac{I_t}{S_t}\right)} \qquad \text{Equation 8}$$

Equation 9

$$F_3 = \frac{\varepsilon_f \left(\frac{S_f}{S_t}\right)}{\varepsilon_h \left(\frac{S_h}{S_t}\right) + \varepsilon_f \left(\frac{S_f}{S_t}\right) - \eta \left(\frac{I_t}{S_t}\right)}$$

In which, η is the demand elasticity of domestic investment, ε_h is the elasticity of supply for household savings, and ε_f is the elasticity of supply for foreign funds with respect to the changes in the market interest rate. In addition to that, I_t is the total private investment, s_h is the total saving by households, s_f is the total capital inflow by foreigners, and S_t which is the total private saving is the sum of these two components.

Chapter 4

ESTIMATING THE ECONOMIC OPPORTUNITY COST OF CAPITAL FOR KENYA

4.1 Introduction

The main purpose of this thesis is to develop an analytical framework which will enable us to calculate the economic opportunity cost of capital for Kenya. At this point, all the necessary data has been assembled to estimate EOCK for Kenya according to Equation 1.

The EOCK can be estimated as the weighted average of the rate of returns on displaced domestic investment π, domestic saving γ, and the foreign saving MC_f. Thus by substituting the estimated values for π, γ, MC_f, and the estimated weights, the EOCK can be calculated for a country.

Later, a sensitivity analysis should be done on the key parameters to get a range of results, and estimate an average value of this range to consider as the final result. The key parameters range from country to country, but usually the most sensitive parameters are the initial share of each sector in total private savings, the supply elasticity of foreign capital, and the rate of return on domestic investment.

4.2 Real Rate of Return to investment in Kenya

As it was discussed earlier in chapter 3, we use a top-down approach to estimate the contribution of capital to Kenya's GDP. To calculate this value we should consider

the GDP net of the contribution made by labor, land, sales and excise taxes, and the economic depreciation of the capital stock. Table 1 presents the calculation of the rate of return to investment.

Starting from GDP, we subtract the estimated share of labor from GDP, which is assumed to be 35% of GDP, for each year between 1990-2011. Then, we estimate the contribution of land to GDP as 33% multiplied by the share of the crop agriculture times the GVA of the agricultural sector, and deduct it from GDP.

The next step is to account for the taxes and subsidies produced by capital and labor which are a part of GDP at market prices. According to the east African tax guide, taxes in Kenya include Pay-as-you-earn (PAYE), corporate income tax (CIT), other personal income tax (PIT), value added tax (VAT), and excise duties. Since the VAT payment is borne entirely by the value added of labor, it should be deducted from GDP. Furthermore, the value of the net taxes on products and depreciation should also be deducted from the GDP value. By doing so, we get the value of the income attributed to the stock of reproducible capital during the period 1990-2011. This value should be then divided by the stock of reproducible capital, which we got from the Penn World Table (PWT), which can be used for the purpose of estimating the ECOK.

Table 1: The real rate of return to investment in Kenya (1990- 2011) - current prices (million shilling)

Indicator Name	GDP	Total Labor Income	Taxes on product	Value Added Tax	Subsidies on Products	Gross Value Added by Agriculture	Share of Crop Agriculture	Depreciation	Gross of Tax income to capital	GDP deflator	Real Income to Capital	Capital Stock	Real rate of return to capital
	1	2	3	4	5	6	7	8	9	10	11	12	13
1990	196433.61	68751.76	30397.95	15321.40	2419.15	49725.47	0.88	15032.71	76734.24	19.97	384206.77	2692314.73	14.27%
1991	224230.07	78480.52	33074.12	18555.40	2632.12	54533.09	0.88	16882.72	88595.20	22.48	394194.12	2743733.27	14.37%
1992	264471.87	92565.16	39570.52	22142.80	3149.12	65539.53	0.88	19812.83	103844.54	26.72	388608.09	2785429.73	13.95%
1993	333611.29	116763.95	54217.88	28994.40	4314.80	89434.56	0.88	23081.52	128418.56	33.59	382319.05	2819674.48	13.56%
1994	400657.84	140230.24	68005.12	24533.80	5412.02	112646.38	0.88	28828.15	156321.11	39.31	397712.25	2873623.92	13.84%
1995	465250.74	162837.76	77665.13	28403.80	6180.79	122591.80	0.88	39549.55	178487.50	43.72	408293.13	2950733.60	13.84%
1996	687998.00	240799.30	78948.96	29850.00	6282.96	189148.00	0.88	61680.00	281526.11	62.07	453553.95	3023201.42	15.00%
1997	770313.00	269609.55	86964.89	34468.20	6920.89	213330.00	0.88	68628.80	315150.94	69.17	455623.81	3093073.49	14.73%
1998	850808.20	297782.87	103193.61	39204.80	8212.41	236056.00	0.88	76030.40	344028.97	73.96	465133.44	3179410.90	14.63%
1999	906927.63	317424.67	110747.17	40944.20	8813.54	260688.00	0.88	85661.10	359669.21	77.07	466705.96	3259318.90	14.32%
2000	967836.93	338742.93	111501.81	50220.80	2582.88	277980.00	0.89	91170.60	381524.74	81.75	466691.51	3355600.16	13.91%
2001	1020221.00	357077.35	123148.47	50871.60	9800.47	284124.00	0.89	94384.10	406169.55	83.04	489142.91	3483165.36	14.04%
2002	1035373.00	362380.55	126529.54	56135.20	10069.54	267685.00	0.87	98454.40	413878.26	83.81	493818.04	3585781.45	13.77%
2003	1131782.00	396123.70	136591.28	58853.40	10870.28	292050.00	0.89	109849.52	450379.24	89.01	506010.08	3665587.78	13.80%
2004	1274329.00	446015.15	150193.87	75995.60	8715.87	317678.00	0.88	121126.42	509830.35	95.35	534697.55	3768661.59	14.19%
2005	1415725.00	495503.75	173595.83	77732.00	19398.83	343119.00	0.88	123575.25	581958.47	100.02	581835.83	3953750.15	14.72%
2006	1622567.00	567898.45	201360.27	96497.00	22907.27	386402.00	0.87	128298.79	678336.78	107.81	629199.68	4199850.04	14.98%
2007	1833513.00	641729.55	248045.96	111904.60	30544.96	404184.00	0.87	136587.23	772654.20	113.86	678583.76	4490259.20	15.11%
2008	2107460.00	737611.00	293282.55	126854.00	44064.55	480203.00	0.86	150179.58	890788.56	128.91	691033.20	4813394.15	14.36%
2009	2365453.00	827908.55	332694.97	141970.80	47244.97	565191.00	0.87	167580.18	989812.73	140.84	702816.54	5132123.38	13.69%
2010	2551161.00	892906.35	360862.83	174342.00	42377.83	560654.00	0.87	180622.24	1067917.03	143.61	743608.20	5478960.51	13.57%
2011	2985878.83	1045057.59	436030.11	52958.74	52958.74	741251.00	0.88	199018.63	1321000.02	161.04	820305.34	5880436.55	13.95%

Table 2: The real rate of return to investment in Kenya (1990- 2011) - current prices (million shilling)

Indicator Name	GDP	Total Labor Income	Taxes on product	Value Added Tax	Subsidies on Products	Gross Value Added by Agriculture	Share of Crop Agriculture	Depreciation	Gross of Tax income to capital	GDP deflator	Real Income to Capital	Capital Stock	Real rate of return to capital
	1	2	3	4	5	6	7	8	9	10	11	12	13
1990	196433.61	68751.76	30397.95	15321.40	2419.15	49725.47	0.88	15032.71	76734.24	19.97	384206.77	2692314.73	14.27%
1991	224230.07	78480.52	33074.12	18555.40	2632.12	54533.09	0.88	16882.72	88595.20	22.48	394194.12	2743733.27	14.37%
1992	264471.87	92565.16	39570.52	22142.80	3149.12	65539.53	0.88	19812.83	103844.54	26.72	388608.09	2785429.73	13.95%
1993	333611.29	116763.95	54217.88	28994.40	4314.80	89434.56	0.88	23081.52	128418.56	33.59	382319.05	2819674.48	13.56%
1994	400657.84	140230.24	68005.12	24533.80	5412.02	112646.38	0.88	28828.15	156321.11	39.31	397712.25	2873623.92	13.84%
1995	465250.74	162837.76	77665.13	28403.80	6180.79	122591.80	0.88	39549.55	178487.50	43.72	408293.13	2950733.60	13.84%
1996	687998.00	240799.30	78948.96	29850.00	6282.96	189148.00	0.88	61680.00	281526.11	62.07	453553.95	3023201.42	15.00%
1997	770313.00	269609.55	86964.89	34468.20	6920.89	213330.00	0.88	68628.80	315150.94	69.17	455623.81	3093073.49	14.73%
1998	850808.20	297782.87	103193.61	39204.80	8212.41	236056.00	0.88	76030.40	344028.97	73.96	465133.44	3179410.90	14.63%
1999	906927.63	317424.67	110747.17	40944.20	8813.54	260688.00	0.88	85661.10	359669.21	77.07	466705.96	3259318.90	14.32%
2000	967836.93	338742.93	111501.81	50220.80	2582.88	277980.00	0.89	91170.60	381524.74	81.75	466691.51	3355600.16	13.91%
2001	1020221.00	357077.35	123148.47	50871.60	9800.47	284124.00	0.89	94384.10	406169.55	83.04	489142.91	3483165.36	14.04%
2002	1035373.00	362380.55	126529.54	56135.20	10069.54	267685.00	0.87	98454.40	413878.26	83.81	493818.04	3585781.45	13.77%
2003	1131782.00	396123.70	136591.28	58853.40	10870.28	292050.00	0.89	109849.52	450379.24	89.01	506010.08	3665587.78	13.80%
2004	1274329.00	446015.15	150193.87	75995.60	8715.87	317678.00	0.88	121126.42	509830.35	95.35	534697.55	3768661.59	14.19%
2005	1415725.00	495503.75	173595.83	77732.00	19398.83	343119.00	0.88	123575.25	581958.47	100.02	581835.83	3953750.15	14.72%
2006	1622567.00	567898.45	201360.27	96497.00	22907.27	386402.00	0.87	128298.79	678336.78	107.81	629199.68	4199850.04	14.98%
2007	1833513.00	641729.55	248045.96	111904.60	30544.96	404184.00	0.87	136587.23	772654.20	113.86	678583.76	4490259.20	15.11%
2008	2107460.00	737611.00	293282.55	126854.00	44064.55	480203.00	0.86	150179.58	890788.56	128.91	691033.20	4813394.15	14.36%
2009	2365453.00	827908.55	332694.97	141970.80	47244.97	565191.00	0.87	167580.18	989812.73	140.84	702816.54	5132123.38	13.69%
2010	2551161.00	892906.35	360862.83	174342.00	42377.83	560654.00	0.87	180622.24	1067917.03	143.61	743608.20	5478960.51	13.57%
2011	2985878.83	1045057.59	436030.11	52958.74	52958.74	741251.00	0.88	199018.63	1321000.02	161.04	820305.34	5880436.55	13.95%

Note: Column (9) = (1)-(2)-(4)-((6)*(7)*33%)-((2)/ ((1)-(3) + (5))*((3)-(4))-(8) ; Column (11) = (9) / (10) ; Column (13) = (11) / (12)

4.3 The Real Rate of Return to Domestic Savings in Kenya

As we mentioned earlier, there is an opportunity cost to consumers from the decrease in their consumption in order to supply of new savings. The way to calculate this rate was explained completely in chapter 3. Starting from the gross-of-tax income to reproducible capital and deducting the taxes on income, profit, and capital gains and the financial service charges, we get the return to domestic saving. By dividing this value by the capital stock, we can obtain the rate of return to domestic savings, as it is shown in table 2.

The final estimate suggests that the average real rate of return to domestic savings for the period of 1990-2011 would be 10.14%, which can be used as γ value in estimating the EOCK.

Table 3: Estimation of the real rate of return to domestic savings-current prices (million shilling)

Indicator Name	Gross of tax income to capital	Financial Service charges	Taxes on income, profits and capital gains	Return to Domestic Savings	GDP deflator	Real Return to Domestic Savings	Capital Stock	Rate of Return to Domestic Saving
	1	2	3	4	5	6	7	8
1990	76734.24	7917.78	12983.00	55833.45	19.97	279556.97	2692314.73	10.38%
1991	88595.20	9038.20	14262.00	65295.01	22.48	290522.59	2743733.27	10.59%
1992	103844.54	10660.25	17028.00	76156.29	26.72	284992.84	2785429.73	10.23%
1993	128418.56	13447.10	19970.00	95001.46	33.59	282831.92	2819674.48	10.03%
1994	156321.11	16149.59	36767.00	103404.52	39.31	263081.83	2873623.92	9.16%
1995	178487.50	18753.18	43506.00	116228.32	43.72	265874.21	2950733.60	9.01%
1996	281526.11	27731.61	48082.00	205712.50	62.07	331414.08	3023201.42	10.96%
1997	315150.94	31049.54	48375.00	235726.40	69.17	340797.21	3093073.49	11.02%
1998	344028.97	34294.11	55578.00	254156.86	73.96	343624.71	3179410.90	10.81%
1999	359669.21	36556.16	54402.00	268711.05	77.07	348678.86	3259318.90	10.70%
2000	381524.74	46394.10	55688.52	279442.12	81.75	341821.25	3355600.16	10.19%
2001	406169.55	42132.88	58957.97	305078.70	83.04	367400.96	3483165.36	10.55%
2002	413878.26	41838.57	70140.28	301899.41	83.81	360210.70	3585781.45	10.05%
2003	450379.24	45097.21	77410.00	327872.03	89.01	368370.78	3665587.78	10.05%
2004	509830.35	48992.29	99312.48	361525.59	95.35	379159.15	3768661.59	10.06%
2005	581958.47	52851.74	108897.66	420209.08	100.02	420120.52	3953750.15	10.63%
2006	678336.78	60079.92	131426.61	486830.25	107.81	451565.43	4199850.04	10.75%
2007	772654.20	68995.60	165155.00	538503.59	113.86	472940.93	4490259.20	10.53%
2008	890788.56	80212.42	194154.50	616421.64	128.91	478191.84	4813394.15	9.93%
2009	989812.73	93938.74	219496.84	676377.15	140.84	480261.60	5132123.38	9.36%
2010	1067917.03	104447.78	272263.87	691205.39	143.61	481297.68	5478960.51	8.78%
2011	1321000.02	126268.45	312463.34	882268.23	161.04	547864.75	5880436.55	9.32%

Note: Column (4) = (1) – (2) – (3) ; Column (6) = (4) / (5) ; Column (8) = (6) / (7)

4.4 Marginal Economic Cost of Foreign Capital Inflow in Kenya

When a country such as Kenya increases funds in the capital market, a proportion of them will be sourced from abroad. Kenya is constrained in its ability to service its debt. The greater is the amount of foreign debt, the greater will be the country's exposure to repayment risk on existing debt, and it will also cause an increase of interest payment on any existing debt.

As it was mentioned earlier in chapter 3, in light of these dynamics of an economy we can calculate the marginal cost of capital inflow using the following formula.

$$MC_f = \left[\frac{i_f \bullet (1 - t_f) - gP^f}{1 + gP^f} \right] \bullet \left[1 + k \bullet \left(1 / \varepsilon_f \right) \right] \qquad \text{Equation 10}$$

According to World Bank, the amount of long-term external debt was 7565.5 million US dollars for Kenya in 2011, and they were all sourced either by public institutions or publicly guaranteed ones. In terms of their currency, the majority of the external debt was denominated by Euro, US dollars, and Japanese Yen with the share of 34%, 32%, and 15.1% respectively. Also 65% of the total external debt accounts for multilaterals versus the 31.7% by bilateral. The debt provided by multilaterals is usually with a low fixed interest rate, so we assume the debt financed by bilateral is a loan with a variable interest rate, so k in the equation above is assumed to be 35%. Also the latest data showed that the nominal interest rate charged on the foreign loan was on average 15.05% for Kenya in this period. The withholding tax rate levied on interest payment to a non-resident in Kenya is 15%. And finally by assuming a 2% foreign inflation rate because of the currency composition of the debt, and the supply elasticity of 2 for the stock of foreign funds, we can estimate the marginal cost of foreign borrowing for Kenya. Replacing the mentioned values in the formula, we obtain 12.43% for MC_f value.

4.5 The Economic Opportunity Cost of Capital (EOCK) for Kenya

As was described in previous parts, the EOCK can be measured as the weighted average of the rates of return to investment, domestic saving, and foreign savings, which are estimated so far. The weights of the three diverted funds can be estimated according to the table 3.

Table 4: Parameters for estimating share of each parameter

1	2	3	4	5
elasticity of demand for domestic investment	supply elasticity of household saving	supply elasticity of foreign funds	total saving by household/total private sector saving	total foreign capital inflow/total private saving
-1	0.4	2	85%	15%

Based on the estimated rates of π, γ, MC_f and the corresponding share of each rate, the EOCK for Kenya is estimated as 12.77%.

Table 5: Estimating the Economic Opportunity Cost of Capital (EOCK)

	Returns	**Shares**	**Return * Share**
Investment	14.21%	51.93%	7.38%
Domestic Saving	10.14%	25.54%	2.59%
Foreign Saving	12.43%	22.53%	2.80%
EOCK			12.77%

Given the status of Kenya development, and other countries with similar condition that's a sensible rate of EOCK. But in order to make sure, we should do some sensitivity analysis on the key estimated parameters to see the range of change on EOCK resulting from a change in those parameters.

4.6 Sensitivity Analysis for the EOCK

Here we present a detailed result of the sensitivity analysis on the key parameters of our estimation in tables 5-14.

Table 6: Share of labor income in GDP

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
30%	16.12%	12.05%	12.43%	14.25%
33%	14.97%	10.90%	12.43%	13.36%
35%	14.21%	10.14%	12.43%	12.77%
40%	12.30%	8.23%	12.43%	11.29%
45%	10.39%	6.32%	12.43%	9.81%

As we can see in table 5, changing the share of labor income in GDP has a major impact on the estimation of the EOCK. A change of 30-45% of labor income's share in GDP can result in a range of 9.81-14.25% of the EOCK value, which is more than 3 percentages of variation in our estimation. So, this component is a major factor in determining the value of EOCK.

Table 7: Contribution of land to the crop agriculture

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
15%	15.64%	11.57%	12.43%	13.87%
20%	15.24%	11.17%	12.43%	13.57%
25%	14.84%	10.77%	12.43%	13.26%
30%	14.45%	10.38%	12.43%	12.95%
33%	14.21%	10.14%	12.43%	12.77%
35%	14.05%	9.98%	12.43%	12.65%
40%	13.65%	9.59%	12.43%	12.34%

In table 6, the contribution of land to the crop agriculture has been considered. A change from 15% to 40% in this variable causes less than 1% change in the estimated value of EOCK.

Table 8: Portion of capital stock attributable to the remunerative capital

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
60%	15.39%	10.99%	12.43%	13.60%
65%	14.21%	10.14%	12.43%	12.77%
70%	13.19%	9.42%	12.43%	12.06%
75%	12.31%	8.79%	12.43%	11.44%
80%	11.55%	8.24%	12.43%	10.90%

Table 7 shows different portions of capital stock attributable to the remunerative capital changes. A change of 60-80 percent of this value will cause in a result from 10.90% to 13.60% for the EOCK. Obviously this is also a wide range of change in our estimation, thus the share of capital stock is another key factor in the estimation of economic opportunity cost of capital for Kenya.

Table 9: Share of foreign borrowing with floating interest rate

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
5%	14.21%	10.14%	10.84%	12.41%
15%	14.21%	10.14%	11.37%	12.53%
25%	14.21%	10.14%	11.90%	12.65%
35%	14.21%	10.14%	12.43%	12.77%
45%	14.21%	10.14%	12.96%	12.89%
55%	14.21%	10.14%	13.49%	13.01%
65%	14.21%	10.14%	14.02%	13.13%
75%	14.21%	10.14%	14.55%	13.25%

In table 8 we examine a change of 5% to 75% in the share of foreign borrowing. Although the variation in this value is big, the impact it has on the estimation of

EOCK is less than 1%. Therefore, it is not considered as a key factor in our estimation.

Table 10: Foreign inflation rate

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
1%	14.21%	10.14%	13.72%	13.06%
2%	14.21%	10.14%	12.43%	12.77%
3%	14.21%	10.14%	11.17%	12.48%
4%	14.21%	10.14%	9.93%	12.21%
5%	14.21%	10.14%	8.72%	11.93%

Rate of foreign inflation is the next component that takes the values from 1-5% in table 9, and as a result the EOCK varies from 11.93% to 13.06%. This range of change is slightly bigger than 1%, so this component does not have a major effect on our estimation.

Table 11: Elasticity of foreign funds

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
1.5	14.21%	10.14%	13.05%	12.91%
2	14.21%	10.14%	12.43%	12.77%
2.5	14.21%	10.14%	12.06%	12.69%

Table 12: Elasticity of demand for domestic investment

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
-0.5	14.21%	10.14%	12.43%	12.26%
-1	14.21%	10.14%	12.43%	12.77%
-1.5	14.21%	10.14%	12.43%	13.07%

Table 13: Supply elasticity of household savings

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
0.2	14.21%	10.14%	12.43%	13.15%
0.3	14.21%	10.14%	12.43%	12.95%
0.4	14.21%	10.14%	12.43%	12.77%
0.5	14.21%	10.14%	12.43%	12.61%
0.6	14.21%	10.14%	12.43%	12.47%

As we can see from the tables, a change of about 1 percentage in the elasticity values will result in a change of less than 1% in the estimation of EOCK. Thus change in elasticity values will not cause a major change in our estimation.

Table 14: Share of household savings in total private-sector savings

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
55%	14.21%	10.14%	12.43%	13.03%
65%	14.21%	10.14%	12.43%	12.94%
75%	14.21%	10.14%	12.43%	12.85%
85%	14.21%	10.14%	12.43%	12.77%
95%	14.21%	10.14%	12.43%	12.69%

Table 15: Share of foreign savings in total private-sector savings

	Return to Investment	**Return to Domestic Savings**	**Return to Foreign Inflow**	**Economic Opportunity Cost of Capital**
	14.21%	10.14%	12.43%	12.77%
5%	14.21%	10.14%	12.43%	12.83%
15%	14.21%	10.14%	12.43%	12.77%
25%	14.21%	10.14%	12.43%	12.72%
35%	14.21%	10.14%	12.43%	12.69%
45%	14.21%	10.14%	12.43%	12.66%

Finally, in tables 13 and 14 we change the share of household and foreign savings in total private-sector savings. Applying a 40% change in each of these shares will result in a change of almost 0.5% in the estimation of the EOCK, which is a small variation.

According to the above sensitivity analysis, our estimate is mostly sensitive to the assumption we made for the share of labor in GDP and portion of capital stock attributable to the remunerative capital. These two are the key parameters in the estimation of the EOCK for Kenya, and a little change in the value of either of them result in a big change in our estimation. As we can observe from the above tables the estimates would range from 9.81% to 14.25%. From the sensitivity analysis done on the factors, we can conclude that a 12% real discount rate is the appropriate value for Kenya to be used in investment appraisal and choosing the best project for implementation in this country.

Chapter 5

CONCLUSION

Having a proper and appropriate social or economic rate to be used in discounting returns form projects is vital for investment decision making in each country, and the appropriate rate to be used as this value has been debated over the past 50 years.

This thesis has described analytical frameworks and practical approaches to the estimation of a proper value as the economic opportunity cost of capital for Kenya. This national parameter is the key component in determining whether a project is worthwhile to be undertaken or not by discounting the net economic benefits and costs of investment projects.

The model used in this thesis for estimating the economic opportunity cost of capital considers the capital market as the source of raising funds. This approach take into account both the opportunity cost of funds diverted from private consumption and private domestic investment, and the marginal cost of borrowing from foreign countries, which are the three main sources of funds raised from the capital market.

Using this framework, the empirical estimations show that the EOCK would have a value of 12.77 % approximately in real terms in the base case for Kenya.

On the next step, we have done a sensitivity analysis on all of the parameters involving in this estimation to observe the range of changes in the estimated EOCK

as a result of a change in these parameters. And we found the key ones that have a major impact on our estimation are the share of labor income in GDP, and proportion of capital stock attributable to the remunerative capital. The sensitivity analysis shows that the estimated discount rate ranges from 10% to 14.5% in real terms.

As a conclusion, a 12% real rate seems like the suitable discount rate for Kenya to be used in investment decision making, and it is also the social discount rate used by the African Development Bank (AFDB) for the economic appraisal of investment projects. Given the limited resources in Kenya, for a project to be undertaken in this country, its economic NPV -using this opportunity cost- should be positive, and among those projects with a positive NPV the one with the greatest value of NPV should be implemented.

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