Rates of Return to Capital, and the Economic Opportunity Cost of Capital in EAC Countries and Ghana

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ABSTRACT

This research provides an analytical framework and an application to estimate the rate of return to capital, and the economic opportunity cost of capital (EOCK) intended for EAC countries consisting of Kenya, Rwanda, Tanzania, and Uganda, as well as the EOCK for Ghana. These parameters have a vital role in the evaluation of public investment projects. They expect to help policymakers at all levels of government improve investment allocations and project selection to ensure that the highest value public projects are chosen and financed in order to achieve more efficient utilization of resources.

The marginal productivity of capital is a key variable in estimating the economic opportunity cost of capital. This study estimates the real economic rates of return to reproducible and remunerative capital of the EAC economies. The results indicate that the rates of return to reproducible capital in real terms over 1999 –2016 have averaged 10.70% in Kenya and Rwanda, while it averaged 12.05% and 9.86% in Tanzania and Uganda, respectively. With regard to the marginal rates of return to remunerative capital, the results suggest that EAC countries have averaged 16.28%, 16.21%, 15.07%, and 14.49% in Tanzania, Rwanda, Kenya, and Uganda, respectively, over the same period.

The economic discount rate is derived for the East African Community (EAC) countries and Ghana on the base of the economic opportunity cost of funds sourced through domestic and international capital markets. The economic opportunity cost of each different source of funds, namely, the return to domestic investment, the rate of

return of household saving, and the marginal economic cost of foreign financing, have been estimated for each country. Using a weighted average method, the results indicate that the EOCK are: 11.5% for Kenya, Uganda and Ghana, and 12.5% for Rwanda and Tanzania.

Keywords: Discount Rate; Capital Return; Opportunity Cost; Public and Private Investment; Cost-Benefit Analysis; Economic Growth.

ÖZ

Bu araştırma, Kenya, Ruanda, Tanzanya, Uganda ve Gana 'dan oluşan Doğu Afrika Topluluğu (EAC) ülkelerine yönelik sermayeye geri dönüş oranını ve kaynakların ekonomik fırsat maliyeti tahmin etmek için analitik bir taslak ve bir uygulama sunmaktadır. Bu parametreler, kamu yatırım projelerinin değerlendirilmesinde hayati bir role sahiptir. Parametreler, devletin her düzeyindeki politika üreticilerine, kaynakların daha verimli kullanımını sağlamak için en yüksek değere sahip kamu projelerinin seçilmesini ve finanse edilmesini sağlamak için yatırım tahsislerini ve proje seçimini iyileştirmelerine yardımcı olmayı fırsatı sunuyor.

Sermayenin marjinal üretkenliği, sermayenin ekonomik fırsat maliyetini tahmin etmede kilit bir değişkendir. Bu araştırma, EAC ekonomilerinin yeniden üretilebilir ve kârlı sermayeye gerçek ekonomik getiri oranlarını değerlendirmektedir. Sonuçlar, 1999-2016 yılları arasında yeniden üretilebilir sermayeye getiri oranlarının reel olarak Kenya ve Ruanda'da ortalama %10.70 iken, Tanzanya ve Uganda'da ortalama %12.05 ve %9.86 olduğunu göstermektedir. Ücretli sermayeye marjinal getiri oranları ile ilgili olarak, sonuçlar EAC ülkelerinin aynı dönemde Tanzanya, Ruanda, Kenya ve Uganda'da sırasıyla ortalama %16.28, %16.21, %15.07 ve %14.49 olduğunu göstermektedir.

Ekonomik indirgeme oranı, Doğu Afrika Topluluğu ülkeleri ve Gana için, yerel ve uluslararası sermaye piyasalarından sağlanan fonların ekonomik fırsat maliyeti temelinde elde edilir. Her bir farklı fon kaynağının ekonomik fırsat maliyeti, yerli yatırıma geri dönüş, hanehalkı tasarrufunun getiri oranı ve dış finansmanın marjinal

ekonomik maliyeti her ülke için değerlendirilmiştir. Ağırlıklı bir ortalama yöntem kullanıldığında, sonuçlar Ekonomik indirgeme oranı'nin: Kenya, Uganda ve Gana için %11.5; Ruanda ve Tanzanya için %12.5 olduğunu göstermektedir.

Anahtar Kelimeler: İndirim Oranı; Sermaye Getirisi; Fırsat maliyeti; Kamu ve Özel Yatırım; Maliyet Fayda Analizi; Ekonomik Büyüme.

DEDICATION

To my mother for her encouragement,

to my wife Thekra for her devotion and support,

to my children Thabit & Ali;

and

to the memory of my father

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LIST OF ABBREVIATIONS

AFDB	African Development Bank
CBA	Cost Benefit Analysis
CRP	Country Risk Premium
DIP	District Industrialization Programme
EAC	East Africa Community
EOCK	Economic Opportunity Cost of Capital
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GRA	Ghana Revenue Authority
GVA	Gross Value Added
ICSD	Investment and Capital Dataset
ILO	International Labor Organization
IMF	International Monetary Fund
NHIL	National Health Insurance Levy
NPV	Net Present Value
PIM	Perpetual Inventory Method
PPP	Public Private Partnership

PWT	Penn World Table
SAM	Social Accounting Matrix
SPC	Shadow Price of Capital
VA	Value Added
VAT	Value Added Tax

Chapter 1

INTRODUCTION

1.1 The Objective of the Thesis

This thesis aims to estimate the real rate of return to reproducible and remunerative capital for East Africa Community (EAC) countries and the 'economic opportunity cost of capital' (EOCK) in four members of EAC in addition to Ghana.

Using the national accounting system, the return on reproducible and remunerative capital is estimated by calculating the income accruing to the reproducible and remunerative capital stock. The economic opportunity cost of capital reflects the cost of borrowing created in the economy whenever the government raises funds to finance public investment projects by resorting to the capital markets as the source of funds. Given that the 'economic opportunity cost of capital' is calculated as a weighted average of the opportunity cost of the various sources of funds obtained to finance the project, the marginal rate of return to remunerative capital we discuss in chapter three is used to reflect the economic cost generated in the economy in the form of the displaced new investment project in the private sector. Other sources represent an increase in domestic savings and a positive response from international capital inflows to an additional demand for funds.

This chapter is organized into three sections. The following section describes some characteristics of the EAC and Ghana economies that reflect an investment's

performance and the challenges the public sector faces in these countries. Finally, section three describes the structure of the thesis.

1.2 Public Investment and The Role of Economic Opportunity Cost of Capital in EAC and Ghana Economies

EAC is a regional bloc comprising Kenya, Uganda, Tanzania, Rwanda, Burundi, and South Sudan. Recently the community has become a significant regional market and a center of development and stability throughout East Africa. It has a market of more than 172 million people, with almost a quarter being urban population. The combined gross domestic product of the community stood at 173 billion USD in 2017.

The EAC has been on a steady growth path in recent years. Between 2004 and 2017, real economic growth has been, on average, 5.9 percent per year. In 2017, the region's weighted real growth was a robust 5.26 percent, driven by Rwanda and Tanzania with a 6 percent growth rate.[1] EAC countries maintained their lead in Africa growth with economic growth of 7 percent in 2018, up from 5.26 percent in 2017.

EAC countries' economic growth was mainly attributed to higher infrastructure investment in advanced economies, specifically roads, rail, electricity, and increased private consumption.[2] This growth is in line with a general consensus that a scaling-up investment in low income countries, specifically in infrastructure projects, is essential to achieving steady economic growth (Dabla-Norris *et al.*, 2012).

[1] See Regional economic outlook. Sub-Saharan Africa. International Monetary Fund, 2018.

[2] See, EAC Trade and Investment Report 2017.

EAC economies have increasingly become integrated into the global economy through trade and financial markets channels. This level of integration, along with natural resource discoveries, enhances their abilities to attract a sizeable amount of both domestic and foreign investment. The national accounts data show that investment rates in Tanzania, Uganda, and Rwanda increased over the last decade and a half. The share of 'gross fixed capital formation' (GFCF) in the GDP in Tanzania reached 34.25% in 2015, up from 16.35% in 2000, and investment rates continue to be above 30% from 2011 until 2017. In Uganda, the GFCF reached its peak in 2013 with 27.94% of GDP, up from 19.23% in 2000. The gross fixed capital formation (GFCF) for Rwanda grew from 13.38% of GDP in 2000 to 25.82% in 2015 and stood at 22.91% of GDP in 2017. Over the same period, Kenya experienced a somewhat lower capital formation rate compared to other East African countries. With a few exceptions, Kenya's investment rates throughout the period have been less than 20% of GDP.[3]

Concerning foreign investment, the EAC countries have been performing well in terms of attracting international investment. Across the community, inflows of foreign direct investment (FDI) increased from USD 593.5 million in 2000 to 4801.73 million USD in 2012. In 2017, the FDI amounted to 2998.39 million USD, in which Tanzania accounted for 1180.4 million USD of this inward investment, Uganda for a further 699.73 million USD, while Kenya and Rwanda received 671.74 million USD, 366.21 million USD, respectively.[4]

[3] Data of GFCF are obtained from World Bank, World Development Indicators.

[4] The figures are obtained from UNCTAD database. (unctadstat.unctad.org/wds/TableViewer/tableView.aspx)

Despite the increases in recent years, investment in infrastructure in EAC remains low. The poor infrastructure in this region constitutes a significant challenge to achieving sustainable development goals. In 2018, East Africa Community (EAC) reported that it needs an investment amounting to USD78.73 billion in priority infrastructure projects over the next ten years to reinforce the region's economic activity.[5] Furthermore, the region still faces many challenges in bridging its investment needs with tax-to-GDP ratios that are still far below the 25 percent threshold that would enable scaling up infrastructure spending.[6]

With regards to Ghana, the country's upgrade from low to lower-middle-income status in 2011 was through a steady economic growth accelerated. Despite its sluggish growth performance from 2014 to 2016[7], the real GDP growth grew by an impressive annual average of 6.71% for the years between 2005 and 2016. In 2017 and 2018, the growth rate again increased to 8.44% and 6.3%, respectively.[8]

Even though the total investment rate has been high in recent years, this level of investment alone is not enough for Ghana to reach its targeted per capita growth rates without increasing the productivity of this investment capital. Furthermore, Ghana still faces many challenges in terms of bridging its investment requirements with domestic revenues at about 10 percent of GDP and gross financing needs over 20 percent of

[5] See, EAC, (February 2018), Joint EAC Heads of State Retreat on Infrastructure and Health Financing and Development.

[6] Tax revenue relative to GDP ratio is still low in all EAC countries with 15.7%, 13.6%, 11.8% and 13.7% in Kenya, Rwanda, Tanzania and Uganda, respectively. (Sources: World Bank, World Development Indicators)

[7] The average real growth rate has slowed down by 3.85% from 2014 to 2016.

[8] In September 2018, the GDP base year changed from 2006 to 2013 and causes an increase in nominal GDP of 2017 by 24.6 percent. The gross value added by mining and quarrying sector has increased by 128%

GDP.[9] In recent times, Ghana's government has launched the District Industrialization Programme (DIP). The objective of this Programme is to develop one or more medium-to-large-scale industrial enterprises in each district in Ghana by means of public-private partnerships (PPPs) to address the challenges of extreme poverty and underdevelopment among semi-urban and rural groups. The government's role is to facilitate and support the programme in the form of incentives and infrastructure, as well in secured funding to be invested into some projects.

The common challenge either in EAC countries or Ghana is that the large infrastructural deficits across all sectors and the considerable amount of both ongoing and new public projects increases the need to enhance the efficiency of the provision of public infrastructure by applying the appropriate discount rate that would improve investment allocations and project selection processes to make sure that the best investment projects are selected and funded.

Even though investment in infrastructure decisively contributes to growth in the national economy (Aschauer,1989), the level of investment would not be translated into faster economic growth rates and making the growth effect more persistent if this investment's capital productivity is not increasing. With the existence of a crowding-out effect caused by public demand for funds on private investment, the selection of public investments yielding social returns lower than the opportunity costs of funds is economically non-viable. It can reduce output and productivity growth as the resources they employ would have made a higher benefit elsewhere in the economy. According to Agénor & Moreno (2006), In the short term, scaling up the public capital’s stock in

[9] See, African Economic Outlook (2019).

infrastructure may adversely impact the growth, to the degree that it crowds out private investment. If the fall in private capital investment persists over time, this short term impact could be translated into an adverse growth effect.

Improving the growth effect and minimizing inefficiencies in the government's use of capital requires that any public investment is expected to yield a higher return in social terms than what would be earned by the economy if the funds were left in the capital market. Accordingly, the economic discount rate of the borrowed funds deemed to be appropriate if it is sufficient to compensate for the weighted average cost of (1) replacing investment displaced, (2) forgone consumption that to some degree will be postponed, and (3) in an open economy, paying for incremental funding from abroad.

Furthermore, the opportunity cost of capital also has an essential role in the choice of technology for a project during the project design process. “The use of a lower financial cost of capital instead of its economic opportunity cost would create an incentive to use production techniques that are too capital intensive. The choice of an excessively capital-intensive technology would lead to economic inefficiency because the value of the marginal product of capital in this activity is below the economic cost of capital to the country”. (Jenkins et al., 2019).

To the extent of our knowledge, calculation of the economic opportunity cost discount rate has not yet been carried out for most African countries except South Africa (Kuo, Jenkins, & Mphahlele, 2003). In this context, chapter four and chapter five of this study aim to empirically estimate the ‘economic opportunity cost of capital’ for EAC

and Ghana economies, respectively.[10] These rates have a practical use as a discount rate in the CBA of those countries' public projects to ensure that its resources are better utilized to help meet each country's growth goals as set out in its development strategy.

1.3 The structure of the Thesis

This thesis is organized into six chapters; after this introduction, Chapter 2 presents a literature survey for theoretical foundations of different methods in estimation of the economic discount rate in addition to a brief review of the recent debate on this topic. Chapter 3 deals with computing and analyzing the rate of return to reproducible and remunerative capital in EAC economies by use of national accounts and some other information. Chapter 4 is connected to Chapter 3 and concentrates on estimating other components that need to compute the economic opportunity cost of capital applied in public investment appraisal. In Chapter 5, we set forth to calculate the economic discount rate for Ghana. Finally, in Chapter 6, we conclude the study by briefly evaluating the thesis's objectives.

[10] We could not proceed with the estimation for Burundi and South Sudan as much of the data required is not available.

Chapter 2

LITERATURE REVIEW OF THE THEORETICAL FOUNDATIONS OF THE DISCOUNT RATE FOR EVALUATION OF PUBLIC INVESTMENT PROJECTS

2.1 Overview

As a result of the heightened interest in benefit-cost analysis in the 1950s and 1960s, a vigorous and exciting debate among economists on determining the appropriate economic discount rate and the economic value of public investment has entered economic literature. From a theoretical standpoint, two perspectives on the discount rate emerge from contemporary economic thought; one focusing on consumers' relative preferences for current versus future consumption. The other focuses on the value of the opportunity cost of investment displaced due to the increase in public investment.

The economic discount rate has an important and decisive role in guiding government investment decisions and public spending. It reflects the government valuation of outcomes that occur in the future compared to those that occur within the present in order to assess the public investment's net impact on society's wellbeing. When the appropriate economic discount rate is applied in the analysis, a positive sign of net present value will demonstrate that a greater wealth or efficiency can be reached if the

project is carried out. In other words, the project generates sufficient benefits to compensate all individuals entirely.

The first reason why future costs and benefits need to be discounted arises from opportunity costs, meaning that when resources are committed to a particular investment project, there is an opportunity cost associated with that investment in the form of forgone private investment (Dasgupta and Pearce 1972), as the resources could be invested elsewhere in the economy to generate a positive return on investment. Thus, to induce investment, the project's expected returns must cover its costs and produce benefits more than employing the fund in alternative use.

The second reason for discounting future benefits and costs is due to people's preference for the present over the future; that is, consumption of goods and services at the present time is generally preferable to later consumption. Individuals do that when the level of consumption is expected to rise over time, and the 'marginal utility of consumption' is expected to decrease.[11] Individuals may also exhibit a positive pattern of "pure time preference" even without changes in the level of consumption in the future, due to impatience and risk of future mortality.

Despite more than a half-century of debate, the appropriate method of selecting an economic discount rate to be employed when carrying out a public investment evaluation is still a highly controversial topic in economics.

[11] i.e., if one already has more consumption, the expected utility from an extra consumption would be lower. This is called 'diminishing marginal utility', indicating that consumers will derive higher utility from current consumption than the future consumption because they expect their level of consumption to be increased in the future because of economic growth.

According to Burgess & Zerbe (2011), The sources of discrepancy in this issue include the adjustments for risk, crowded out of the private investment, ‘rate of time preference’, “ethical issues as whether the varying wealth of future generations should allow for rates that reflect preferences for income”, and finally whether some goods such as human lives are unique and should not be subject to discount.

This section's main goal is to outline the theoretical foundations of the main approaches that have dominated literature on the discount rate used when conducting an appraisal for public investment projects. Based on efficiency criteria, methods for determining the economic discount rate are generally placed into three categories. The first one is the evaluation of consumption that is related to the ‘social rate of time preference’ approach about society's willingness to give up an amount of consumption today in exchange for more in the future but only after adjusting the costs by the ‘shadow price of capital’ to take into account the existence of a higher marginal productivity rate of return on the displaced investments. The second viewpoint of growth maximization focuses on the highest rate of return of an investment available outside of the public sector that could be financed by these funds. It has usually been the case that this option is to finance investment projects in the private sector. The third method takes into account the social opportunity cost of public investment as well as the impact of public investment on consumption spending, considering the capital market is the marginal source of funds. This method is founded on the contributions of Harberger. It recommends the use of a weighted average of the ‘marginal productivity of capital’ in the private sector, the ‘rate of time preference for consumption’, and the ‘marginal cost of foreign financing’, with the value of weights representing the fractions of funds diverted from displaced investment demand,

forgone consumption (increase in domestic supply of savings) and foreign savings when the government enters into a borrowing operation in the capital market.[12]

2.2 A Brief Literature Survey

Under certain assumptions, the first method, 'shadow price of capital' is almost equivalent to the weighted average discount rate approach as it considers forgone consumption as well as the effects of displaced private investment due to government expenditure. (for example, Sjaastad & Wisecarver 1977 ; Burgess & Zerbe, 2011).

The 'shadow price of capital' method was initially described by Marglin (1963) and later systematically developed by Bradford (1975). In Lind's (1982) words,

> "If one accepts the argument that the appropriate way to look at public investment decisions is to trace the impacts on consumption over time and then to discount at the social rate of time preference, then the appropriate procedure is to compute the shadow price of capital and to multiply the costs of public investment that represent a displacement of private capital by this shadow price to obtain the true opportunity cost in terms of consumption".

The need for shadow-pricing public investment is that private investment is crowded out by public investment, but the opportunity cost of public investment cannot be measured by the market price. "Shadow prices are prices that reflect the opportunity cost of resources, and thus they measure the economic cost or benefit of inputs and outputs" (Potts 2002).

According to Feldstein (1964b), cost benefit analysis is a technique that attempts to deliver a criterion that shapes public investment decisions. It must consider the social

[12] Social rate of time preference as supported by: (Marglin, 1963), (Feldstein, 1964a), (Sen, 1961), (Lind, 1982), (Bradford, 1975). Social opportunity cost of capital advocates by: (Baumol, 1968), (Mishan, 1967), (Diamond, P. & J. Mirrlees.,1971a). The Weighted average approach as supported by: (Harberger, 1969), (Usher, 1969), Ramsey (1969), (Sandmo & Drèze, 1971), (Sjaastad & Wisecarver, 1977), (Harberger & Wisecarver, 1977), Boadway (1978), Hagen (1983), Marchand and Pestieau (1984), (Burgess D, 1988), (Jenkins, Kuo, & Harberger, 2019), (Burgess & Zerbe, 2013), and (Harberger & Jenkins, 2015).

opportunity cost of the funds used in the governmental project besides society's social time preference.

The ‘social opportunity cost’ (SOC) of public investment is clarified by Marglin (1963b) as “a function of the displaced private investment, reinvestment of the proceeds of a project and yield rates”. Feldstein (1964b) suggested that the SOC of any public funds must reflect both the direct and indirect reductions of private investment and thus asserts that the SOC of funds diverted to the public sector from the private sector is the discounted value of the consumption benefit that is forgone as a result, discounting at the social time preference rate.

The theoretical basis for determining the social rate of time preference to be used as a social discount rate of consumption generated by an investment that has been financed either by taxation that reduces consumption, or the consumption-equivalent of displaced investment, has been provided originally by Marglin (1963a, 1963b). He implicitly assumes that public investment projects are financed with resources that come exclusively from consumption, by paying taxes or buying treasury bonds. For this reason, the opportunity cost is constituted by the sacrifice of present consumption by members of society. This sacrifice is measured through the time preference rate since this reflects the increase in future consumption that members of society desire as a reward for each present consumption unit sacrificed. For the purpose of estimating the ‘rate of time preference’, Marglin (1963b) suggests working backward from the optimal rate of growth to the discount rate that ensures a level of investment that achieves this optimal level of growth. Feldstein (1964a) specified solid arguments not to use market interest rates to determine the time preference rate as it does not reflect the positive effects of current public investment on future private investment. Instead

of that, Feldstein (1964a) suggested that ‘social discount rate’ should be a function of the population growth rate and the pure time preference rate.

To consider this effect of reinvestment of the proceeds of a project, Bradford (1975) has refined and generalized Marglin's model on the shadow price of capital problem. He provides a straightforward explanation having computed the shadow price of capital (SPC) using different assumptions for the marginal rate of return, the social rate of time preference, and the marginal propensity to save under the usual premises of full employment. He demonstrated that the SPC varies with the length of the project's life, the funding source of the government project, and the various forms of private capital formation.

Arrow (1966) particularly specified “the problem of choice of the social discount rate as one of the determinants of the optimal growth path for an economy. He mentioned that the private investment displaced in one year leads to displacing investment and consumption in future years that would have been financed by the returns on the initial displaced private investment. On the contrary, the returns to public investments eventually accrue to either consumers or entrepreneurs and hence finance future higher levels of consumption and private investment than would have been possible absent the initial public investment. As Arrow stated, to evaluate a particular project adequately, one should evaluate the whole stream of future consequences for the private sector and not just the immediate displacement of private investment”. (Robinson, 1990).

The second method proposes that the appropriate economic discount rate for public investment evaluation must reflect the opportunity cost return forgone by displacing

other private investments for a given productive capital. The basic idea is that a public project displaces private investment; consequently, “a public investment project needs to produce a return that is at least equal to the return which would be obtained by the displaced private project” (Baumol 1968). On the other hand, the forgone consumption that can be displaced by public investment projects is not considered in this approach.

This second approach dates back to Mishan's (1967) comments on an original essay by Marglin. In his article, Mishan (1967) pointed out important deficiencies that affect the validity of Marglin's discounting formulation to evaluate the time streams of benefits and costs produced by public investments. Consequently, Mishan thought there was no significant discrepancy between the social discount rate and the marginal productivity of capital. Therefore, the true discount rate in public investment evaluation should meet the economic (social) opportunity cost of capital.

Baumol (1968) perceived “a basic contradiction” between efficiency in resource allocation between the public and private sectors and the public's time preference. In his paper, Baumol emphasized the fundamental ideas again and argued that the appropriate discount rate for government projects is the rate that reflects the true opportunity cost of displacement of any benefit generated by public investment. Given the existence of market distortions such as taxes, investments for either individuals or corporations must yield returns significantly higher than the public's subjective consumption rate of interest to be undertaken. Thus, equilibrium in the economy exists such that social time preference rates are much lower than rates of return available in the private sector.

For example, individual and corporate income taxes introduce a wedge between the consumption rate of interest for individual and market interest rates and the corporate pre-tax rate of return on investment because corporate after-tax returns from investments must equal the returns earned on savings by consumers and investments in the non-corporate sector.

Baumol noted that this results in an “inconsistency problem” because the consumption rate of interest reflects the discount rate that has to be applied for optimal allocation of available resources. However, the corporate pre-tax rate of return on investment reflects the opportunity cost of public projects. Furthermore, he considered that whether resources of public investment projects are transferred by taxation or by borrowing is generally “irrelevant to the choice of a social discount rate; that instead, all that mattered was the rate of return that resources diverted to the government could earn if they were in the private sector”, and that this rate of return was actually close to a private sector return.

In the so-called “second-best approach” where the choice of social discount rate is properly adjusted for distortions in the market such as corporate income tax, Usher (1969) cleared up the Baumol dilemma “by deriving the social discount rate associated with an optimal level of government investment in a second-best world showing that the discount rate lies between the consumer rate of interest and the pre-tax rate of return on corporate investment”.

Ramsey (1969) argues that Baumol's work is a restrictive situation representing a particular case where entire funds are diverted from the private sector. However, in the real economy, various sectors, different types of taxation, and different rates of return

are available. Accordingly, the source of financing government projects is crucial and has an important impact on the rate of return that must be generated by a public project.

Based on the opportunity cost approach, Ramsey (1969) presented further conclusions on the appropriate social discount rate that can be a linear combination or a weighted average of the private pre-tax-rate of return to capital and the consumption rate of interest. The weights rely on how individuals in the private sector react to the transformation of resources. Furthermore, the time preference rate does not need to be explicitly considered again as “consumers' rate of time preference is reflected in observable market rates of return” and is accounted for in the "weighting" process. Hence, Baumol's inconsistency dissolves, and the appropriate discount rate becomes an empirical matter.

The third method to determine the economic discount rate dates back to Harberger (1969) and Sandmo and Dreeze (1971). This approach is called the economic opportunity cost of capital and perhaps has had the most considerable influence on public policy guidelines among the different approaches.

Harberger, among economists, is one of the strongest supporters of the adoption of a weighted average discount rate. In his influential paper (1969), he proposed the most compelling case for this approach when he derived a weighted average economic discount rate in a perfectly competitive closed economy with no production or consumption externalities but with distorting effects of taxation on capital income.

When a public project raises the demand for capital, thus leading to displacement of both consumption and private investment and that, therefore, the proper economic

discount rate is determined as the weighted average of the economic cost of the resources used to finance the marginal investment allocated through a market clearance mechanism, whereas the weights reflect the relative contributions that investment and consumption would make toward funding the project and equals the impact of interest rates on both of them.

This method's application is based on Harberger's idea that “an opportunity cost of capital applies equally to private investment, private saving (consumption), public borrowing, and taxation. The marginal effect of each of those comes through its effect on the market interest rate and would be the same. He treats the capital market as a ‘sponge’ that absorbs any increment of government funds that may result from an increase in tax yields and yields up the funds to finance any increment of government expenditures. Once a person has said this, then the opportunity cost of capital takes on normative significance for project evaluation even though it may have little import for monetary and fiscal policy”. (Harberger, 1969).

Harberger & Meier (1985) argue for a convention that the capital market is the marginal source of funds for any investment. The reasons for building the estimation of the ‘economic opportunity cost of capital’ on a capital-market sourcing model are that; the weights are relatively stable, and the capital market is the de facto marginal source’ and depository of funds in the short and middle run. Furthermore, in open economies, the calculation can be readily adapted to incorporate sourcing of financing from the world capital market to the analysis. (Harberger, 1996).

Taking into consideration international capital mobility, Sandmo & Drèze (1971) incorporated foreign financing as another source of funds for public investment. They

expanded a standard closed economy model to an open economy context in which foreign investors also bought the government's bonds. The elasticity rate on foreign funds is now also inserted to calculate the social opportunity cost of capital. With the existence of a country risk premium, Edwards (1986) discusses that the country faces an upward sloping supply curve of foreign borrowing, and public projects impact the relevant marginal cost of foreign indebtedness. Therefore, the marginal economic cost of foreign funds is increasing above the average cost of foreign funds.

Burgess (1988) suggests the marginal rate of return on public funds is a weighted average of the marginal social productivity of capital of private investments and the marginal rate of private time preference for consumption. “The weights are also depending on the degree of complementarity or substitutability between public and private investment in addition to the shares of funding obtained from each source through incremental borrowing”. Furthermore, Burgess (1988) has come to the conclusion that due to complementary public investment with private investment, the positive externalities of public investment can be regarded as part of benefit streams and, hence, no adjustments to the weights are needed.

This study uses the method of the weighted average for the determination of the economic discount rate considering the performance of the real economy, which could serve as a benchmark for best practice in the context of East African Community (EAC) and Ghana economies.

According to Burgess and Zerbe (2013), the economic opportunity cost of capital satisfies the potential Pareto test and offers a higher probability of optimal investment decisions compared with other methods. If a project yields benefits that are regarded

as equivalent to income by the private sector, an appropriate criterion should be the social opportunity cost; that is, benefits and costs should be discounted at a rate equal to the economic opportunity cost of borrowed funds, which is the rate of return the society as a whole forgoes when project funds are raised in the capital to finance the public investment project. (Burgess, 2013).

The weighted average approach is consistent with the discount rates employed by many international organizations and professionals. The objective is to employ a discount rate for a country so that the project with a positive economic net present value will deliver enough surplus of benefit to compensate the lost benefits arising from financing the government project through borrowing from the capital market. In other words, an investment project should provide a return enough to cover its opportunity costs.

In chapters two, three and four, we will define and examine this approach in further detail.

2.2.1 Arguments for Discounting Intergenerational Projects

Although issues relating to climate change and other environmental problems are outside this thesis' domain, we feel that a brief survey on this issue would shed light on the recent debate in regard to the appropriate rate of discount in analyzing the costs and benefits of environmental change.

All three approaches described above have in common that the discount rate is time-invariant, which leads to the exponential discount function. On the other hand, environmental economists argue that exponential discounting is biased and cannot solve the intergenerational equity issue since it discriminates against future

generations. Based on ethical considerations, they conclude that discounting benefits and costs accruing to future generations at a rate lower than the marginal return to capital is required.

Chichilnisky (1997) argues that there would be a 'tyranny' of the present generation with constant rate discounting over the future ones. In this way, the discount factor considerably decreases the weight placed on consumption flows in the long-term, making future generations irrelevant to the decision-maker.

To properly consider long-term environmental problems, Heal (1997), also suggests that a decreasing discount rate over time would be more appropriate than a time-constant discount rate.

In recent years, the Stern Review (Stern 2007) has generated a new impetus to the debate for choosing the appropriate discount rate. He argued how the investment decisions taken in the next decade or so would profoundly affect the climate in this and the next century. More clearly, if no immediate and dramatic response is adopted, greenhouse gases' present emission levels would create catastrophic consequences for future generations; hence, immediate action must be taken. Thus, Stern (2007) concluded that it is entirely inappropriate for projects addressing climate change to use market rates of return as a basis for the social discount rate. Instead, he argues for discounted future costs and benefits at a low rate of discount at 1.4%.

In response to Stern (2007), Nordhaus (2007) criticizes the Review for an extreme assumption about employing a very low discount rate, amplifying the distant future's effects and justifying immediate cuts in carbon dioxide emissions. On the other hand,

Nordhaus (2007) suggests applying a discount rate of 5.5% based on the estimated market-return to capital.

Similarly, Dasgupta (2007) disagreed with the Stern review (2007) and mentioned that the large, immediate steps on climate change recommended in the report indicate the authors' viewpoint on intergenerational equity, which has not been driven much by the new climatic facts they stressed.

Another source of foundations for using a declining discount rate over long horizons adopted by some economists to account for the role of uncertainty in the discount rate. Among others, Weitzman (1998, 2001) argues that the near future and distant future have to be considered differently due to the long-term effects of uncertainty. As compared with the near future, the distant future has greater uncertainties in the factors of future productivity. Consequently, "there is a wide range of possible discount rates for the far future. A 'certainty equivalent discount rate' should be calculated as a weighted average of these possible discount rates". Weitzman clarifies that as the time periods extend towards infinity, the discount rate moves closer towards the lowest possible of the range.

Gollier (2002 a,b) treats consumption growth as uncertain over the long term. He suggests the discount rate should decline over the medium-term in the period from fifty to one hundred years and decline further over the very long-term (over 200 years).

Other empirical literature has applied estimated 'certainty-equivalent discount rates' based on historical data of interest rates (Newell and Pizer 2003; Groom et al. 2007; Hepburn et al. 2009).

One problem with declining discount rate "is that it generates 'time-inconsistent' planning, a person who applies a declining discount rate may not carry out the consumption plans made at the current time and could reverse the decisions in the future even though no new information emerges". (Cropper and Laibson, 1998).

This conceptual problem suggests that intergenerational equity issues should be addressed directly rather than lower the discount rate (Schelling 1995, and Lesser and Zerbe 1995). Notably, "some argue that in the context of global warming mitigation, one should not simply apply a lower discount rate to evaluate costs and benefits of projects; in cases where there may be significant irreversibility and potential questions of intergenerational equity, one should not rely on the project discount rate alone. Instead, a full analysis of all these concerns and options should be carried out separately and explicitly for informed choice and decision-making (Lind 1997, Nordhaus 1999, Kopp and Portney 1999, and Toman 1999)". (Zhuang et al., 2007).

For example, Zerbe (2004) argues that the logic of wealth maximization requires discounting. "The dilemma in choosing the discount rate for intergenerational projects can be addressed by realizing that the problem is one of concern over missing values that arise from ignoring ethical values. This deficiency could be overcome by the incorporation of moral values directly into the cost benefit analysis and, inter alia, recognizing all values for which there is a willingness to pay". As the current generation is willing to pay to avoid future moral harm, this is incorporated into the analysis.

2.2.2 Intergenerational Interests and the Opportunity Cost of Investment

The economic viability of the investment project crucially depends on the chosen discount rate to be adopted in CBA. Since the early days of economic cost benefit

analysis, economists have been in agreement on the standard view that the use of an incorrect estimate of the economic discount rate would lead to a very serious misallocation of resources. (Baumol, 1968).

In reviewing recent literature in the previous section, we have seen in recent years how some academic literature for modelling costs and benefits of climate change has again raised the debate regarding the assumptions underlying the social discount rate in analyzing the impacts of environmental change. More specifically, some papers have put forward arguments for applying a low discount rate in CBA of public projects that have benefits over long time horizons.

Given that the basic question of cost benefit analysis is about what projects among existing possibilities we should choose in order to achieve the best promote economic efficiency, the starting point for selecting discount rates used in the CBA is the opportunity cost of capital. The cost of investment projects is not solely the value of the resources employed. It also implicates the opportunity cost of those resources. Since the resources to be used in investment projects are limited, the rate of return to a proposed investment must be compared with the return of the alternative uses, and thus the analyst's job is mainly to assess the net benefits of an investment, informing policymakers where the investible funds can yield the best returns among the available opportunities in the economy.

Given that there are hundreds or thousands of investment options across various sectors, the purpose of discounting in the appraisal of public projects is to select the rate which best promotes economic efficiency in terms of maximizing net present values of public benefits, in a way that this rate leads to a selection of more productive

project over another that is less productive, and thus, enables the government to cut lots of inferior projects and lead it to invest in high yield ones to meet the economic targets of development plans of the country and to provide best benefits to the current and future generations.

The rate then has to cover at least the productivity forgone due to displaced capital investment and forgone current consumption as a result of undertaking the investment project. A rate of return lower than the weighted average represented by the opportunity cost of capital would not pass this test.

Seen this way, the approach of advocates for lowering discount rates on ethical grounds to reflect moral concerns for long term projects is not a sound approach and cannot evade the capital penalty of disregarding the correspondingly higher economic rate of return (productivity) of capital in various sectors.

Since the early days in this debate, some economists argue that a government discount rate lower than the market interest rate leads to a shifting of current resources from the private sector to the public sector, as public investment is restricting private investment. For example, Marglin, Hirshleifer and Baumol, among others, have indicated that the intergenerational issue is not merely a problem of government investment policy but also of private investment policy. Suppose there is an agreement that the market rate of interest results in insufficient savings to benefit future generations. In that case, “this is not grounds for using a lower discount rate in evaluating public projects compared to private projects-instead; fiscal and monetary policy should be used to lower the market rate of interest instead of adjusting the discount rate” (Quirk and Terasawa, 1987).

The fundamental intuition underlying the social opportunity cost method is that the government should select projects that maximize the resources available for future generations, not those that maximize particular aspects of future welfare, such as environmental wellbeing. Because the economic constraints facing the next generations is unknown to the present generation, the current generation should invest in their general well-being by choosing the projects that yield the highest return. (Morrison, 1998).

According to Weisbach & Sunstein (2008), the market rate of return measures the returns from the current portfolio investment projects. Hence, as an initial point, the market rate is a measure of the opportunity costs of this choice. Thus, the discounting procedure must be based on the market rate to choose projects. Project selection and ethical considerations to the future are, to a great degree, separate. Seen in this way, the ethicists' criticism of the proponents' opportunity cost argument is fundamentally irrelevant. It does not matter whether the current market interest rates are ethically correct because they still represent the opportunity costs of investment.

We believe that satisfying future generations' needs is best served if investable resources are directed towards the projects and programs with the highest return on investment. This is not likely to happen if the policymakers commonly accept projects that provide smaller returns than the return to the economy from leaving resources in the country's capital market. To apply a lower discount rate than the opportunity cost of capital for long-term projects is to either reduce the wealth passed on to future generations or to transfer wealth to the future from the current generation at a higher cost to the current generation than necessary. (Burgess & Zerbe, 2011)

By all the odds, everyone shares a concern about environmental ethics issues; however, we believe that addressing these issues by merely adjusting the discount rate used in CBA is not the appropriate way to make decisions that will benefit future generations. As Birdsall & Steer (1993) point out, allocating resources to a lower rate of return when higher returns are available is wasteful as it implies a loss of welfare and of income that might have been devoted to environmental objectives.

The fact that environmental investment has frequently been woefully neglected is not because discount rates have been too high, but due to the failure to adjust for the costs of the damage to the environment in cost benefit estimations. (Birdsall & Steer, 1993). This sort of adjustment should occur by adequately incorporating environmental costs and benefits into the analysis of projects. In other words, if the present generation has moral obligations towards future generations, "these should be counted in terms of WTP at present and not incorporated into the discount rate. This provides an effective means to address equity concerns without adjusting the discount rate used in the analysis". (Burgess & Zerbe, 2011).

Chapter 3

ESTIMATION OF THE RATE OF RETURN TO CAPITAL IN THE EAST AFRICAN COMMUNITY COUNTRIES (EAC)

3.1 Introduction

The main goal of this chapter is to estimate the economic rate of return to reproducible capital in the East African Community (EAC) countries from 1999 to 2016. Reproducible capital here includes capital owned by the private sector as well as that owned by the public sector but excludes land and natural resources.

The economic "rate of return to capital represents the contribution of reproducible capital to the economy as a whole" (Jenkins & Kuo, 2007). The historical rate of return on capital for each economy is a key parameter as it establishes a realistic foundation for analyzing the contribution of capital to the process of growth. Harberger (1998) expresses the capital contribution to the growth rate as $(\rho + \delta)(\Delta K/y)$. "Where ρ is the net rate of return attributed to investment and δ is the depreciation rate assumed to apply; ΔK is the net increase in the capital stock" (includes both private and public sector investment), and y is the level of real GDP. Expressed in this way capital's contribution to the growth rate is expressed in terms of the real rate of return to capital, and the rate of net investment in the economy.

In this chapter, a further distinction is made between the rate of return to reproducible capital and the rate of return to reproducible capital that is also remunerative. The latter subset of the entire capital stock will include remunerative private investments in reproducible capital as well as the remunerative share of the public sector, such as state-owned enterprises and public-private partnerships. This component of the capital stock represents a narrower class of investments than total reproducible capital. Much of the capital stock owned by the public sector is reproducible, but only a relatively small share of these stocks is both reproducible and remunerative.

The rate of return to displaced reproducible remunerative capital has an important role in estimating the economic opportunity cost of funds that is used for discounting the net resource flows of prospective capital investments. The estimation of the economic opportunity cost of capital (EOCK) is based on the view that "the 'marginal' source of funds for both the public and private sectors is usually the capital market" (Harberger, Jenkins & Kuo, 1998). When the government or any private organization borrows funds via the capital market, these funds must come from three sources: the displacement of other reproducible remunerative capital investments, an increase in domestic saving, and an increase in foreign capital inflows. Hence, the gross of tax return that would have been generated by the displaced remunerative domestic investments (mostly private) is an important component in the derivation of the economic opportunity cost of the financing of real investment projects.

An analysis of the productivity of capital investment at the country level has not yet been undertaken for most African countries. Therefore, this chapter seeks to measure

the yields to tangible capital invested in Kenya, Rwanda, Tanzania, and Uganda.[13] This group of countries represents one of the fastest growing groups of economies in Africa.

This chapter is organized as follows. In Section 3.2, we discuss the methodology for estimating the rate of return to capital. In Section 3.3, we empirically estimate the rate of return for each country. The results are presenting in Section 3.4. Section 3.5 presents a sensitivity analysis of the key variables that affect the estimation. In Section 3.6 we conclude the chapter.

3.2 Methodology

The measurement of the return to capital can be reached by two main alternative approaches; while the two approaches are using the national accounting system they are, however, different in the way of calculating the flow of income generated by capital. The first method has been applied to Canada by Jenkins & Kuo (2007). In this method, the income to capital in the country is estimated by adding up all the returns to capital, which includes profit income, interest income, dividends, rents, and the associated direct and indirect taxes generated by capital. The total income accruing to capital (gross of taxes) is then divided by the 'reproducible capital stock'. The second approach is an "aggregate and top-down approach".[14] In this approach, the income accruing to capital is estimated as the value of gross domestic product net of the income accruing to labor as well as the contributions generated by land, natural resources, associated sales and excise taxes, and the gross consumption of fixed capital. The

[13] We could not proceed the analysis for Burundi and South Sudan as many of the required data are not available.

[14] The approach was first applied by Harberger & Wisecarver (1977) to calculate the rate of return to capital for Uruguay. This method was applied by Poterba (1998) to measure the 'rate of return to corporate capital' in United States, and used by Jenkins & Kuo (1998), Kuo *et al*. (2003) and Coppola *et al* (2014) to estimate the rate of return on capital as one of components used in calculating the economic discount rate for Philippines, South Africa and Mexico, respectively.

second approach is outlined by Kuo et al. (2003) and was applied to estimate the private-before-tax rate of return to capital in South Africa. In this chapter, we adopt the second approach according to the availability and quality of the East African Community countries' data.

3.3 Empirical Estimation

3.3.1 Income Accruing to Capital

The rate of return to reproducible capital (ρ) at time t is the ratio of the value of national income (net of economic depreciation) that has accrued to capital (Y_t^K) to the value of the reproducible capital stock (K_t). Reproducible capital can be owned by either the public and private sectors and can be either remunerative or non-remunerative; their relationship can be written as:

$$\rho = \frac{Y_t^K}{K_t} \tag{3.1}$$

In accordance with Gollin (2002), macroeconomists commonly calculate the shares of production factor not from data at the firm level but from national income accounts data and product accounts. The most used method in order to estimate the share of capital in GDP at current market prices "is to estimate the labor share of national income from the share of employee compensation in GDP. The returns to capital are then taken to be residual" and can be expressed as follows:

$$Y_t^K = Y_t - Y_t^L \tag{3.2}$$

Where Y_t represents the national income and Y_t^L is the total labor income. Moreover, we will need to find the value of GDP after subtracting the contributions related to land and natural resources, associated indirect taxes and the depreciation expense. Therefore, our proposed capital income at time t is specified as follows:

$$Y_t^K = Y_t - Y_t^L - pGVA_t^C - S^L T_t - R_t - D_t \tag{3.3}$$

Where in a given year t, Y_t^K is the return to capital, Y_t is the national income, Y_t^L is the total labor income, GVA_t^C is the gross value added of crop and livestock in the agriculture sector, p is the proportion of land's contribution to GVA_t^C, S^L is Labor's share of national income, T_t represents the sales and excise taxes, $S^L T_t$ is the amount of taxes on products borne by the value added of labor, R_t is the value of natural resource rents and D_t is the depreciation expense associated with the stock of reproducible capital stock.

The first step is to figure out the total 'labor's share of national income' representing the sum of wages and salaries paid to the workers by corporations plus the labor income of the non-incorporated enterprises. Since the owners or the members of unincorporated enterprises are working without receiving wages and salaries, this sector's operating surplus includes income accruing to both labor and capital. Therefore, the faction mixed income corresponds to the labor income for unincorporated enterprises needs to be estimated and added up to the total remuneration paid to employees in the national accounts in order to find out the total income accruing to labor created by the economy in a given year.

For the purpose of this study, the compensation of employees and the gross operating surplus of unincorporated businesses are available from (2007-2017)[15] for Kenya and from (2005 -2016)[16] for Tanzania. Kuo et al. (2003) estimated the share of labor in the income of unincorporated businesses in South Africa at 35% of their operating surplus over the period. Owing to the lower per capita GDP in Kenya and Tanzania compared

[15] The figures are obtained from Kenya data portal. (http://kenya.opendataforafrica.org/rwlckce/kenya-national-accounts)

[16] See National Bureau of Statistics, National Accounts of Tanzania Mainland, 2007 – 2016 November 2017

to South Africa, we expect this share to be slightly lower; hence 33% is used as the labors' share of the operating surplus of unincorporated businesses. Accordingly, the share of labor in GDP for Kenya and Tanzania becomes 39.34% and 38.6%, respectively.[17]

Using ILOSTAT dataset, the employed population and the mean nominal monthly earnings of employee in Uganda are available for all economic activities in 2012. To find out the total annual labor income, we assumed that formal and informal workers receive the same wage rate if working in the same economic sector. The total annual labor income for Uganda is estimated to be UGX 23,609 billion in 2012. To estimate the share of labor income in GDP, we divided this value for annual labor income by the Ugandan national income in 2012 (UGX 61,226 billion). The result suggests that the labor's share of GDP is 38.56%.

We suspect, however, that this estimate to be somewhat of an overestimate of the share of labor as informal sector wages tend to be underrepresented relative to the wage rates of similar skills in the formal sector. The Uganda Bureau of Statistics (2018) indicates that the proportion of informal employment inclusive of the agriculture sector is about to 86 percent. If, on average, the earnings received by workers employed in the informal sector is approximately 15 percent less than average wage rates found in the ILOSTAT then the overall income accruing to labor in GDP for Uganda would be approximately 34%. This estimate is also in line with the observation that the share of labor has an inclination to be lower in countries with lower per capita incomes. The World Bank data shows that the annual GDP per capita in 2016 for Rwanda and

[17] Labor share of national Income at time t = [compensation of employees $_t$ + (0.33 * income of the unincorporated enterprises $_t$)]/ GDP.

Uganda was at $734 and $670, respectively. Significantly lower than the values for Kenya and Tanzania, of $1,559 and $979. Therefore, based on the values of GDP per capita and taking into account the mean nominal monthly earnings of an employee in each country, we use the same base case estimate of the contribution of labor for Rwanda as for Uganda at 34% of GDP. In the empirical estimations that follow, a sensitivity analysis is undertaken with respect to the value of this variable.

Once we exclude the labor income from GDP, the second component to be excluded is the income generated by unimproved land. As unimproved land is not part of reproducible capital, it is not part of the base of our rate of return estimation. However, land is a production factor contributing significantly to the agriculture and housing sectors' value added.[18]

With regard to the agriculture sector, land is a major input only for crop agriculture and livestock.[19] According to Robles (1997), the contribution of land is approximately one-third of the agriculture sector's 'value-added'. Hence, we estimate the contribution of unimproved land in the national income as (1/3) times the share of the crop and livestock agriculture multiplied by the gross value added of the total agriculture sector as shown in Appendix A1 -A4, Columns (6) and (7).

[18] Disaggregated items of the GVA of the agricultural sector is available for all EAC countries. On the other hand, no further disaggregated data are available either on the value added of housing sector nor on the contribution of land to the sector. Accordingly, in the absence of detailed information, the housing sector is excluded from this study.

[19] National data indicates that the gross value added by crop agriculture and livestock as a percentage of GDP is relatively high in all EAC economies. The average annual percentages over the period of the study are 27%, 25%, 23% and 21% for Rwanda, Tanzania, Kenya and Uganda respectively. See, (http://eac.opendataforafrica.org/data#topic=National%20Accounts).

The third component to be deducted from the income to capital is natural resource rents, as it is not a return to reproducible capital. Natural resources combined with reproducible capital gives rise to economic rents. With regard to the estimation of these rents, Tanzania has a considerable amount of resource rents compared with other east African countries. The national figures in 2016 show that the ratio of mining output to GDP in Tanzania is 4 percent while it is about 1 percent in Rwanda and less than 1 percent in Kenya and Uganda.[20] As a consequence of the small share of the mining sector in Rwanda, Kenya, and Uganda, the value of economic rents from natural resources for these countries are not estimated. In contrast, the Tanzanian exports of gold in 2016 accounted for over 35% of their total exports.

In order to estimate the amount of resource rents created by the mining sector of Tanzania one first needs to examine the ways that the government has tried to appropriate these rents. The government levies royalty rates on the value of the mineral sold plus a further 1% charge on all export sales. In addition, the government receives income from the mining sector through the free equity it has received in exchange for the rights of private investors to develop the mines. The income received from the free mining equity is a part of the distribution of resource rents created by the sector. To the extent that there remain economic rents that increase the rate of return to the owners of the mine, this higher than normal rate of return will also be shared with the government through higher income tax payments.

In the period of this study the total payments received by the government from the mining sector has been about 14% of the GVA of the industry. Of this total 4

[20] East African Community Secretariat, 2016.

percentage points have been revenues from mineral royalties. The remainder 10 percentage points are a composite of the income tax from reproducible capital, the payments received from the free equity of the mines and the income taxes levied on the economic rents included in the outputs of the corporations. In the absence of more precise data, we estimate that approximately 5 percentage points represent the corporate tax on reproducible capital and 5 percentage point represent free equity and the corporate tax on economic rents. Thus, the total mineral resource rents of Tanzania equal 4 percentage points of revenues from mineral royalties plus the 5 percentage point representing the free equity and the corporate tax on economic rents received by government. Therefore, the total economic rents of Tanzania that need to be deducted from the national income would be 9 percent of the gross value added of mining and quarrying sector as presented in Column (9) in Appendix A.3.

The fourth component is indirect taxes and subsidies. Indirect taxes mainly include sales tax, excise tax, and customs duties that are all included as in the GDP at market prices. To account for the return to reproducible capital we need to allocate the total amount of indirect taxes between the value-added of capital and the value added of labor.

Regarding sales taxes, Rwanda, Tanzania and Uganda are implementing a value added tax (VAT) at 18% at the current time, while Kenya has a 16% value added tax rate. These value added taxes in all countries are of the consumption-type that apply to the sales of products through various stages of manufacture and distribution. EAC governments allow the vendors full credit for their payments on capital goods like machinery and equipment. Consequently, the value added tax is entirely borne by the

value added of labor. Hence, the total tax collections of VAT have to be excluded from the share of GDP accruing to capital alone.

With regard to excise taxes and customs duties, the fraction of value added by labor corresponds to these taxes and has to be further estimated and excluded from the income accruing to reproducible capital. To do that, we apply the same ratio as the share of income accruing to labor in the gross domestic product in each country and then subtract this amount of taxes from GDP. This is shown in Column (3) of Appendix A1-A4.

Unlike taxes, subsidies reduce the estimated GDP expressed in market prices. Hence, the amount of subsidies attributed to the value added of capital must be added back in order to derive the value added of capital that reflects production costs. In order to do so, we only consider the subsidies on products. Subsequently, a share of subsidies on products that is attributable to the value added of capital must be added to GDP. Production subsidies are very small as a percentage in GDP in these countries and being equal to approximately 1% of gross value added for Rwanda while they are less than 1% in other countries.[21]

After total income accruing to labor and the contributions to GVA made by unimproved land, rents and the associated taxes and subsidies are estimated, the value

[21] We estimated the shares of subsides relative to GDP to be approximately 0.58%, 0.10% and 0.19% in Kenya, Tanzania and Uganda respectively. The calculation is based on incomplete data available at IMF - government finance statistics (GSF).

of depreciation expense needs to be deducted from GDP. The annual values for the depreciation of fixed capital are available through national accounts data.[22]

To this point, we estimated the total amount of return that can be directly accruing to capital (gross of tax) from 1999 through 2016. To find out the real rates of return to capital, the amounts of capital income at current prices must be deflating by the GDP deflator to obtain the capital income in real terms. This step aims to express values for both the capital income and capital stock data in terms of the same price-level. In this study, we identify the price level of 2014 as the base year for all countries, considering that each country has its own specific GDP deflator.[23]

3.3.2 Measuring the Stock of Reproducible Capital

Estimates of the reproducible capital stock by country are available at the Penn World Table database (version .9). Based on the perpetual inventory method (PIM), in any year, "the capital stock is essentially a three-way interaction between a revaluation to the current year's prices of the capital stock from the previous year, the depreciation of capital, and the addition to the stock brought about through investment" in this year (Derbyshire et al., 2013). According to Feenstra *et al.* (2015), the methodology depends on a data set with investment in six assets with their different geometric depreciation rates; the assets are transport equipment, structures, computers, information and communication technology equipment, software, and other machinery and assets. The last available data of capital stock for 2014, in constant 2011 US dollars, shows that Tanzania has accumulated a capital stock of US$ 512.62 billion that is 1.77 and 2.41 times greater than Kenya and Uganda, which have accumulated

[22] See, The World Bank, World Development Indicators

[23] The base year varies by country. Form the World Bank, World Development Indicators, the base years in EAC countries are 2009, 2014,2007 and 2010 for Kenya, Rwanda, Tanzania and Uganda respectively.

a capital stock of US$ 289 billion and US$ 212.41 billion. In Rwanda, the capital stock is much lower compared with other countries and measuring at US$ 34.48 billion. For the sake of comparison, it is worth mentioning that the accumulated capital stock in South Africa in the same year is about US$ 2,166 billion, approximately 4.23 times higher than Tanzania.

As mentioned above, the data of reproducible capital stock in US dollars are available until 2014; thus, there is a need to complete the estimates of the reproducible capital stock for 2015 and 2016. To this end, we followed the method applied by Gupta *et al*. (2014), using the perpetual inventory equation (3.4):

$$K_{it+1} = (1 - \delta_{it})K_{it} + \left(1 - {}^{\delta_{it}}/_{2}\right) I_{it} \quad (3.4)$$

Where for each country i; K_{it} is the initial capital-stock; K_{it+1} is the stock of capital in the year $t + 1$, I_{it} is the flow of gross fixed capital formation during the year t, δ_{it} is a time-varying depreciation rate; $\delta_{it}/2$ is the depreciation rate on the current years gross fixed capital formation in the period assuming that these new investments are on average operational for six months of the year they are introduced.

In order to apply this method, we first use the capital stock estimates in the PWT for January 1st, 1999, and January 1st, 2000, and use the midpoint of those years as the amount of capital stock on mid-1999 and, in the same manner, create a mid-year amount of capital stock from 2000 to 2013. In order to estimate the mid-year capital stock for 2014, 2015, and 2016, we apply equation (3.4) using the mid-year capital stock in 2013 as the initial capital-stock (K_{it}) in estimating the capital stock value as of July 1, 2014, 2015 and 2016.[24]

[24] See, Appendix B1-B4 for details on the construction of the capital stock in each country.

3.3.3 Social Rates of Return to Reproducible Capital

The real rate of return to reproducible capital, including both the component that is privately owned and the part that is government-owned, is estimated as the total gross of tax income accruing to capital during a given period divided by the total capital stock for that period.

This estimate excludes any effect that such investment has on the real wage rate earned by labor. This is the concept of the rate of return on capital, which is employed when estimating the impact of increases in the capital stock that affect economic growth in the economy Harberger (1998) and (2010), Jorgenson (1995). With constant returns to scale (competitive industries), the capital's average return equals its marginal return. To the degree that the consumer surplus created by publicly owned capital is not reflected by the wages paid to labor or in the return to capital, this measure of the rate of return will be an understatement of the total economic or "social" rate of return on the country's capital stock. Furthermore, if such gains in consumer surplus are not included in the national account's estimates of GDP, they will also not be included in the real growth rates of the economy.

3.3.4 Rates of Return to Remunerative Capital and the Economic Discount Rate

In order to identify the discount rate, one needs to examine how the capital market responds to an additional demand for funds from any source. When the economic discount rate for a country is estimated to reflect the opportunity cost of the capital resources employed, one approach is to estimate this variable as the weighted average of the opportunity cost of the various sources of funds obtained via the capital market. These sources include an increase in domestic savings, a positive response from international capital inflows, and a decrease in other new reproducible, remunerative

investments. For each of these components, we need to estimate the marginal rate of return forgone.

Of these three sources, this chapter only attempts to estimate the marginal rate of return to reproducible remunerative capital over the study period. Although the estimate of the social return to all reproducible capital summarizes the capital's contributions to EAC's economic growth performance, such estimates need to be further adjusted to arrive at estimates of the rate of return lost by displacement of new renewable remunerative investment. This will be largely private investment but also includes the responses of state-owned enterprises or public-private partnerships to tighten capital market conditions.

The labor force and the non-remunerative public capital stock are factors of production that join the renewable and remunerative capital stock in producing an economy's output. Pre-existing social capital investments (roads, schools, courts) create an environment that is there regardless of whether we are raising funds today from the capital market. In their overall effect, these social investments surely help raise real wages and influence the private rate of return positively as well. But these effects are "infra margin" as far as our analysis is concerned. It is not likely that there will be any displacement of non-remunerative (social) public sector investment expenditures when there is an increase in borrowing from the capital market.

The proceeds accruing to the capital stock as measured above is the remunerative income accruing to capital. Hence, it is the appropriate value to use in the calculation of the rate of return on reproducible remunerative capital. To estimate the real rate of return on remunerative capital we exclude a non-remunerative share of general

government investment from the reproducible public investment. According to the IMF, Investment and Capital Dataset (ICSD),[25] the average proportion of the private-capital stock plus public private partnership capital stock ranges from 66% to 74% of the total capital stock in the four East African countries during the period 1999-2016.[26] Accordingly, the capital stock series obtained from PWT are multiplied by these ratios to derive the remunerative capital stock in each country.[27]

3.4 Results

Over the last seventeen years, the average gross-of-tax real rates of return (net of depreciation expense) to the reproducible capital stocks over the study period have been estimated at 10.70% in Kenya and Rwanda. In Tanzania, the average social return to reproducible capital is 12.05%, while in Uganda, it averaged 9.86% over this period.[28]

The average rate of return to domestic reproducible remunerative investment (gross-of-tax and net of depreciation expense) is estimated as the aggregate amount of national remunerative income accruing to capital during a given period divided by the stock of remunerative capital for the same period. The estimated real rate of return (net of depreciation expense) to remunerative investment over the study period have been

[25] Total capital stock is consisting from general government capital stock, private capital stock and public private partnership capital stock.

[26] The proportion of private-capital stock in addition to public private partnership-capital stock were approximately 66%, 68%, 71%, 74% for Rwanda, Uganda, Kenya and Tanzania respectively.

[27] Public Investment excludes a state-owned enterprises (SOEs) and parastatals. For more details, see Schwartz (2015).

[28] Detailed calculation for the estimation of these figures are shown in Appendix A1-A4.

15.07%, 16.21%, 16.28%, and 14.49% in Kenya, Rwanda, Tanzania, and Uganda, respectively.[29]

Figure 3.1 depicts the estimates for the average rates of return to total reproducible-capital as well as the return to remunerative-capital in each of East African countries over the period 1999-2016. Although the two estimates pattern is very similar, the divergence between them reflects the differences in measuring the capital stock to be considered the base for calculating the rates of return.

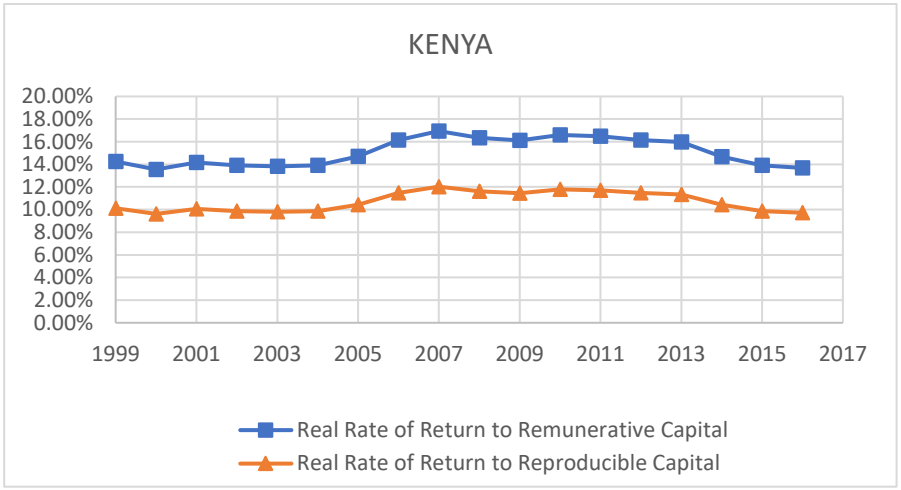
The return to Kenya's reproducible capital fluctuated from 10.11% in 1999 to 9.71% in 2016, mainly affected by its business cycle. Furthermore, a substantial increase in capital return was experienced between 2006 and 2013, with an average return of 11.60%.[30]

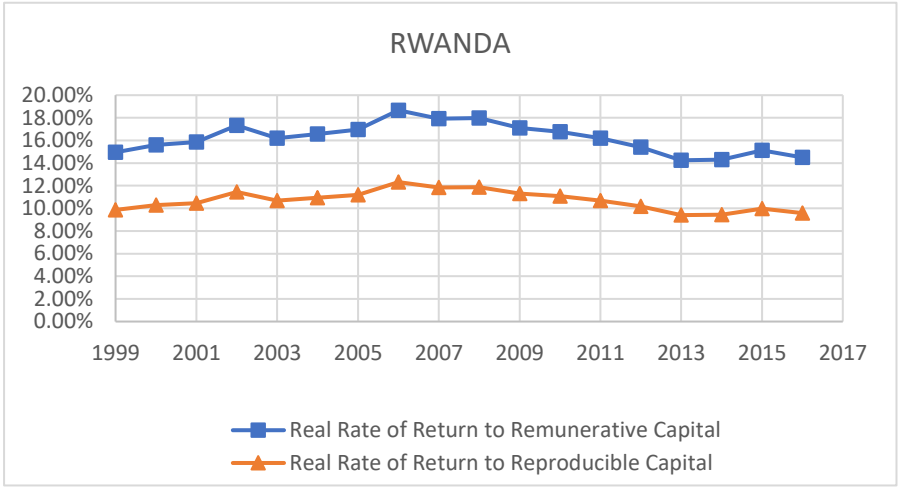
The return to total reproducible capital for the overall economy in Rwanda increased from 9.87% in 1999 and reached a peak in 2006 with a rate of return to reproducible capital at 12.32%. The return to capital in Rwanda began to decline from 2007 and recorded the lowest rate in 2013 when the economy was negatively affected by the suspension of disbursements by a group of donors in late 2012. For Tanzania, Figure 3.1 shows that the return to all capital exhibited an upward trend over the period, with the highest rates of return to reproducible capital at 12.72% in 2007.

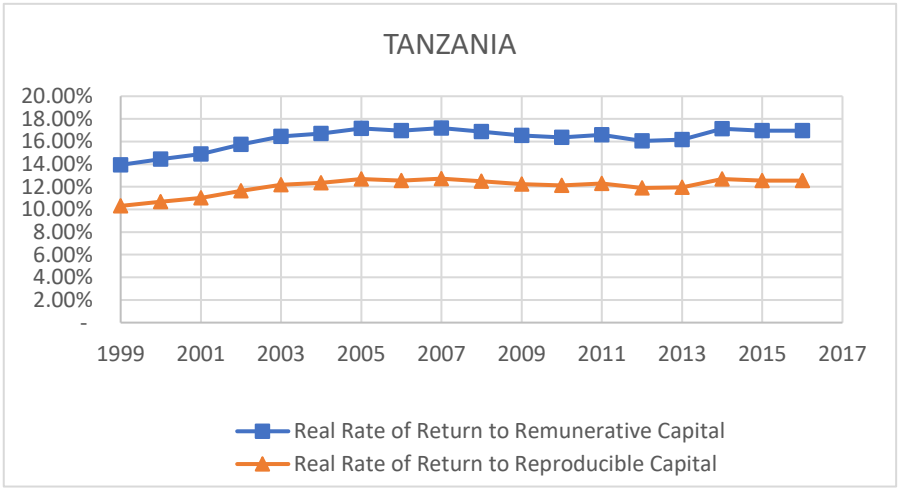
[29] Detailed calculation for the estimation these values are shown in Appendix A1-A4.

[30] One possible explanation for this increase is the revised of the annual and quarterly national accounts statistics made by Kenya National Bureau of Statistics (KNBS) for the period 2006 to 2013. The new estimate reflected the contributions of industries to the economy more accurately and resulted in upward adjustments as improved data sources increased the coverage and revised input-output production structures.

We can see that the rates of return on capital for Uganda tend to fluctuate more than other countries following the substantial fluctuation of real GDP growth throughout the period. The slowing of economic growth in 2012 to 2.2% (from 6.8% in 2011) due in some measure to the tighter fiscal and monetary policies applied by Ugandan authorities significantly affected the return to capital at this period. Figure1 shows that the return to reproducible capital dropped from 10.64% in 2011 to 8.92% in 2012 and continued to fall to 8.53% in 2013.







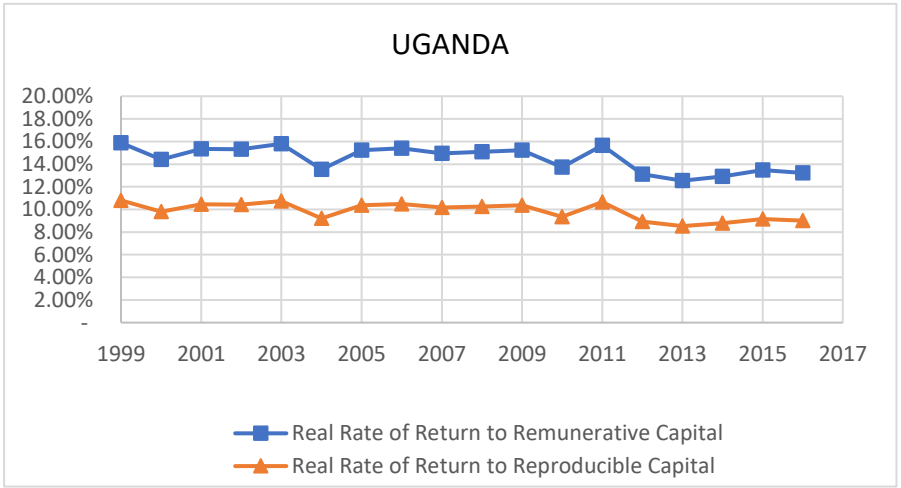


Figure 3.1: Real Rate of Return to Capital for EAC economies: Two Estimates, 1999-2016.

3.5 Sensitivity Analysis

To ensure the estimates' robustness, a sensitivity analysis is conducted to determine how sensitive are the overall rates of return to capital results when the values of main inputs and assumptions change.

The results suggest that the labor income share is an important parameter in estimating the real rates of return to reproducible and remunerative capital in all EAC countries. Furthermore, land contribution to the agriculture sector's value-added is an uncertain parameter for all countries' estimates.

i. The Labor Income Share in GDP

In order to determine the impact of the variation in labor income share (%GDP) on the estimates of the rate of return to reproducible-capital, we consider the ranges of the labor income share in GDP for EAC economies as shown in Table 3.1.

Table 3.1: Estimates of Real Rate of Return to Reproducible and Remunerative Capital with Different assumption of Labor Income Share in GDP (LS)

Country	Labor income share in GDP		Real rate of return to reproducible capital	Real rate of return to remunerative capital
Kenya	*High*	43.34%	9.32%	13.12%
	Base	39.34%	10.70%	15.07%
	Low	35.34%	12.08%	17.02%
Rwanda	High	38.00%	9.65%	14.56%
	Base	34.00%	10.70%	16.21%
	Low	30.00%	11.75%	17.85%
Tanzania	High	42.60%	10.77%	14.55%
	Base	38.60%	12.05%	16.28%
	Low	34.60%	13.33%	18.01%
Uganda	High	38.00%	8.84%	13.00%
	Base	34.00%	9.86%	14.49%
	Low	30.00%	10.87%	15.99%

For Kenya, we have estimated a value of 39.34% for the share of labor in GDP in the base case. If this ratio were reduced to 35.34%, the real rate of return to reproducible capital would rise from 10.70% to 12.08%, which is the highest extreme case for Kenya. On the contrary, if the share of labor in GDP increases by 4 percent above the base scenario, the rate of return to reproducible capital would be at the lowest level of 9.32%.

In Rwanda, if the proportion of labor income is reduced by 4 percent to 30% from the base-case scenario of 34%, the estimated real rate of return on reproducible capital would be 11.75% instead of the base case of 10.70%. However, the estimated rate of return reproducible capital would be 9.65% if we assume the share of labor is 38%.

The base case result of the rate of return to reproducible capital for Tanzania is 12.05%. When the labor income share (%GDP) is 42.60% instead of the base scenario of 38.60%, this will reduce the estimated rate of return to 10.77% for Tanzania. However, in the case that share of labor in GDP decreased to 34.60%, the estimated real rate of return to reproducible capital will rise to 13.33%.

For Uganda, the sensitivity analysis reveals that the estimated real rate of return to reproducible capital would be 10.87% instead of the base case of 9.86% if we assume the share of labor income in GDP to be 30% instead of 34%. If, alternatively, this ratio is assumed to be 38%, the real rate of return to reproducible capital becomes at 8.84%.

With regards to the real rate of return to remunerative capital, if the labor income share is 4 percentage point lower (higher) than the base scenario, the result implies that the

real rate of return to remunerative capital is approximately 1.5 to 2 percentage point higher (lower) than the base scenario.

ii. The Share of the Contribution of Land to the Total Value Added of the Agriculture Sector

The other variable, whose estimated value is challenging to measure, is the share of land contribution to the agriculture sector's total value added. Hence, a sensitivity analysis is undertaken to see how a range estimates of this variable will impact the estimated real rates of return to capital.

Changes in the share of income generated by unimproved land in the total value added of the agriculture sector have a small impact on the estimated rates of return to capital in EAC countries relative to the impact from the changes in labor shares. Table 3.2 reports the impact on the estimated rates when the contribution of land to agriculture varies between 28% and 38%. The range of the estimates of real rates of return to reproducible and remunerative capital in Kenya, Rwanda, Tanzania, and Uganda increases or decreases only by approximately 0.40 to 0.50 percentage point from the base case estimation.

Table 3.2: Estimates of Real Rate of Return to Remunerative Capital with Different Assumption on the Portion of the Contribution made by Unimproved Land to the VA of Crop and Livestock in Agriculture Sector

Country	Share of Land to the total VA of the agriculture sector		Real rate of return to reproducible capital	Real rate of return to remunerative capital
Kenya	High	38.00%	10.32%	14.54%
	Base	33.00%	10.70%	15.07%
	Low	28.00%	11.08%	15.60%
Rwanda	High	38.00%	10.34%	15.67%

	Base	33.00%	10.70%	16.21%
	Low	28.00%	11.05%	16.74%
Tanzania	High	38.00%	11.66%	15.75%
	Base	33.00%	12.05%	16.28%
	Low	28.00%	12.44%	16.81%
Uganda	High	38.00%	9.58%	14.09%
	Base	33.00%	9.86%	14.49%
	Low	28.00%	10.13%	14.90%

3.6 Conclusion

With estimating the rate of return to capital, this chapter attempts to provide analysts and policymakers in EAC countries with estimates of a key parameter that plays a central role in estimating the relative impacts of the sources of economic growth for these countries.

Our findings suggest that the average rate of return to reproducible-capital for EAC countries shows a range of 9.86% to 12.05% in the base case. Our alternative estimates, which consider only the remunerative component of the reproducible capital stock show a range of 14.49% - 16.28% in the average real rate of return to remunerative capital in this regional bloc.

High economic growth rates in these countries are primarily determined by the quantity of new investments undertaken over time. Such high returns to capital in this region point to the importance for policymakers to try to mobilize resources to finance investment in high return reproducible capital in order to put their economies firmly

on a sustainable growth path. The existence of such profitable opportunities for investment in reproducible capital should also motivate public sector investment planners to avoid any public expenditures that are expected to yield in social terms low economic rates of return.

Chapter 4

THE ECONOMIC OPPORTUNITY COST OF CAPITAL: AN ESTIMATION FOR THE EAST AFRICAN COMMUNITY (EAC) COUNTRIES

4.1 Introduction

In this chapter, we apply a weighted average approach using market information in order to estimate the appropriate economic discount rates to be used for appraising investment projects in EAC countries. Estimates of this economic parameter for these countries depend on the size and types of the market distortions, the structure economy, the country's economic performance, and the opportunity cost of funds used in financing investments.

The remainder of the paper is structured into four sections. Section 4.2 Describes the analytical framework used in computing the economic opportunity cost of capital. The empirical estimation of the three components for EOCK and its weights are presented in section 4.3. The EOCK results and sensitivity analysis for each country are shown in section 4.4. Section 4.5 contains conclusions and recommendations.

4.2 Analytical Framework

The economic opportunity cost of capital has been initially developed by Harberger (1969) and Sandmo & Dreeze (1971). The estimation of the (EOCK) is based on the principle that the capital market is usually the truly depository and source of marginal

funds for both the public and private sectors. When the investment project enters the capital market and demand funds, the private demand side for funds as well as the domestic supplies of investible funds are likely to respond to a change in the cost of funds. An increase in the cost of funds causes a postponement of some private investment in the country. On the other hand, domestic consumers tend to postpone their current consumption in order to save more as they can have a greater amount of consumption in the future.

In an open economy context, foreign savings become the third source of funds for financing the marginal investment owing to a higher rate of return in the domestic economy. According to Sandmo & Drèze (1971) and Edwards (1986), the supply of funds from foreign savers depends positively on the rate of interest; hence, more foreign savers are attracted to the country's capital market. In this case, the cost is not solely the cost of servicing the incremental foreign loans but also the additional charges on the existing foreign debt where the interest rate on some of the current stock of debt is contracted at a variable interest rate which is responsive to change in the market rate of the interest.

In sum, the EOCK is a weighted average of the economic cost of funds from the three sources employed to finance the additional demand marginal investment project, with weights reflecting shares of funds extracted from their respective sources. They should be measured by the responsiveness of investors and savers to a change in interest rates caused by the government's additional demand for funds. This can be expressed as:[31]

$$EOCK = f_1\rho + f_2 r + f_3 MC_f \quad (4.1)$$

[31] See, Kuo et al. (2003)

Where ρ refers to the gross of tax rate of return to domestic remunerative capital investment,[32] r stands for the economic cost of newly stimulated household savings, and MC_f for the marginal economic cost of foreign financing. The corresponding weights (fi) represent the share of funds diverted from private sector investors, private sector savers and foreign savers. Obviously, $f1 + f2 + f3$ should equal one.

4.3 Empirical Estimation

Following equation (4.1), estimating the economic opportunity cost of capital requires the estimation of two main sets of components in each country. The first component is presented in section 4.3.1 and is concerned with the estimation of the economic cost of each of the three sources of investment funds, namely, the economic rate of return on displaced reproducible remunerative investments, the rate of return of (household) domestic savings (net of tax), and the marginal economic cost of foreign financing. Section 4.3.2 presents the estimation of shares of these three sources of funds.

4.3.1 The Economic Opportunity Cost of the Different Sources of Public Project Funds

4.3.1.1 The Gross of Tax Rate of Return of Private Domestic Investment (ρ)

In most estimates of the economic discount rate on the basis of the weighted opportunity cost of funds, the largest share of the opportunity cost comes from the reduction in domestic reproducible remunerative capital investments. The relevant

[32] Even though public capital stock is almost always a complementary factor to private capital, for example roads. However, it is not expected that that there will be a displacement of non-remunerative public sector investment expenditures when the government enters into a borrowing operation in the capital market. Hence, it's the reproducible remunerative investments that will be primarily potential private sector investments would be reduced (crowded out). The remunerative capital stock represents a narrower class of investments than total reproducible capital. It includes only the private remunerative investments in reproducible capital as well as the remunerative share of the public sector, such as state-owned enterprises, and public–private partnerships. On the other hand, general government social investments are not likely to be displaced when there is an increase in borrowing from the capital market. In other words, much of the capital stock owned by the public sector is reproducible, but only a relatively small part of the public-owned capital stock is both reproducible and remunerative.

opportunity of funds will be partially determined by the economic return of those investments that will be displaced by the government's capital market operations.

The rate of return on private domestic investment (gross of tax) measures the cost to the economy as a whole when the public project displaces private investment. The measurement of this rate of return to capital in a country is an expression of the ratio of the income accruing to capital to the reproducible remunerative capital stock value, with both variables expressed in terms of the same year prices.

Income to capital in the country is mainly estimated based on national income accounts data[33] and can be obtained as the value of the country's output net of the labor income share, as well as the contributions of unimproved land, natural resources, associated sales taxes and excise taxes and consumption of fixed capital.[34] GDP at current market prices is publicly available for EAC countries from 1999 to 2016. Using this data, the variables above were taken out from the national income to determine the capital return.[35]

In chapter three, we have estimated the marginal rates of return for reproducible remunerative investments in each of these countries. The estimates of those rates over the investigation period (1999-2016) have been estimated at 15.07%, 16.21%, 16.28%, and 14.49% in Kenya, Rwanda, Tanzania, and Uganda, respectively.

[33] National accounts data are the preferred source for the estimation of the real rate of return on capital because they cover all sectors of the economy, therefore reflecting a well-diversified portfolio, and capital is assessed at replacement cost rather than at market values.

[34] This method is outlined by Kuo et al. (2003) and applied for estimating the economic discount rate in South Africa.

[35] Detailed estimation of all variables in this section can be found in chapter 3.

For the purpose of estimating the EOCK according to equation (4.1), we use these results as the value of (ρ) in each country. The estimated real rates of economic return to reproducible remunerative capital in EAC countries are quite substantial, which in turn has important implications for the economic opportunity cost of public investment funds.

4.3.1.2 The Rate of Return on Domestic Savings

The return on domestic savings is a second component that needs to determine a country's EOCK. According to Jenkins *et al*. (2019), raising funds in a country's capital market to finance a new project would augment the market interest rate, or rationing of funds would be tightened to bring the capital market into equilibrium. This will also stimulate additional private savings.[36] These additional savings represent the forgone consumption that has an economic cost equal to the net of tax rate of return of additional domestic savings.

The net of tax return of domestic savings will be estimated as a gross of tax return to the reproducible capital net of corporation income taxes on profits, as well as the amount of taxes on personal income generated from the investment. In addition to that, the property taxes paid by these corporations and householders should be deducted.

Yet, another reasonable adjustment that must be made is the deduction of costs associated with the 'financial intermediation services' in the banking sector in order to achieve the net-of-tax income that actually is received by domestic savers. The reason behind this adjustment is that these intermediation charges reflect an economic

[36] It is noteworthy that crowding out effect in developing countries comes about not necessarily due to a change in market interest rates on borrowing, but might be basically mediated through the credit availability in view of the fact that the credit market markets are less advanced in developing countries and credit rationing could be more general. See, for e.g., Emran & Farazi (2009).

resource cost that is part of the spread between the gross of tax rate of return to investors and the net of tax rate of return to savers. Finally, the national net of tax return to domestic savings is deflated by the country-specific GDP deflator to express all figures in 2014 prices and then divided by the real (2014 price level) values of the remunerative capital stock.[37] The result is the average real rate of return to domestic savings.

Over the study period 1999-2016, the return investors receive from newly stimulated domestic savings that is invested in reproducible remunerative investments in the East African countries have averaged 13.16%, 15.33%, 15.31%, and 13.87% for Kenya, Rwanda, Tanzania, and Uganda respectively. Detailed calculations and formulas are presented in Appendix C1-C4.

These rates of return contain the risk premiums on different types of investments over the period of the study. There is a need to recognize that not everyone who is saving and investing in these countries has the same degree of risk aversion. For those with the highest degree of risk aversion, the difference between riskless government bond rates and the net of tax rates of return on savings and investments reported above reflects the evaluation of the cost of risk. On the other hand, for those individuals who are not risk-averse, the net of tax rate of returns from reproducible remunerative investment will reflect their rate of time preference rate between consumption and saving (investing).

[37] Remunerative capital stock is obtained from Appendix A.

For this purpose, we assume that the distribution of people's risk aversion is linearly distributed between these two extremes. Therefore, the cost of risk for society as a whole would on average be the mid-value of the distance between the net of tax rate of returns from reproducible remunerative investment estimated above and the risk-free rate[38] adjusted for inflation and personal income tax.[39] To determine the average rate of time-preference for consumption (*r*) by the residents in the country who are net savers, we subtracted the average risk premium from the net of tax rate of return to domestic savings.

Table 4.1 presents the calculations of this rate in each country that we will use as the average value of the time preference of individuals (*r*) in the country in the estimation of EOCK. The final estimates suggest that the economic rate of return to domestic savings in real terms are 6.58%, 8.20%, 7.94% and 7.87% for Kenya, Rwanda, Tanzania, and Uganda, respectively.

Table 4.1: The Real Rate of Return to Domestic Savings (r)

Category	Kenya	Rwanda	Tanzania	Uganda
Treasury bills (91 days)	9.25%	8.22%	9.42%	10.71%
Personal income tax rate	15.00%	15.00%	15.00%	20.00%
Treasury bills (net-of-tax)	7.86%	6.99%	8.01%	8.57%
CPI (%YOY)	7.91%	5.92%	7.43%	6.69%
Real rate of return to risk free bond	0.00%	1.07%	0.58%	1.88%
Primary Real Rate of Return to Domestic Savings	13.16%	15.33%	15.31%	13.87%
Risk-Premium	6.58%	7.13%	7.37%	6.00%
Real Rate of Return to Domestic Savings (r)	6.58%	8.20%	7.94%	7.87%

Source: DataStream, EAC Data portal
Notes:
1. Treasury bills & CPI % are the average rate from 1999 – 2016.
2. Real Rate of Return to Domestic Savings (r) = [Primary Real Rate of Return of Domestic Savings - Risk Premium]

[38] Treasury bills are considerably risk-free, or at least low risk financial instrument.

[39] Risk Premium = [Primary Real Rate of Return to Domestic Savings - Real rate of return to risk free bond] / 2

4.3.1.3 The Marginal Economic Cost of Foreign Financing

The final element required for estimating the EOCK is the marginal economic cost of foreign funds. In an open economy context, when the government accesses the international capital market, increasing the demand for investible funds stimulates a supply of savings from foreigners into the economy. As a stock of foreign borrowing increases, the country's risk premium will be increased.

In the case of foreign borrowing, this increase in the country risk premium is an additional cost that will be paid on both the incremental amount of foreign borrowing and will also be charged on all the floating interest rate loans, both current and prior, that has been contracted at a float interest rate basis (Edwards, 1986). The marginal cost of foreign borrowing created by the projects can be calculated as follows:[40]

$$MC_f = \frac{[i_f*(1-t_w)-gP_f]}{1+gP_f} * \left[1 + K * \left(\frac{1}{\varepsilon_s^f}\right)\right] \quad (4.2)$$

where i_f is the average nominal interest rate charged on external loans, t_w is withholding tax rate on interest income, gP_f is the foreign inflation rate, k the proportion of foreign debt contracted in a floating interest rate, ε_s^f is the elasticity of the supply of foreign funds with respect to the interest rate.

The International Debt Statistics data shows that about two-thirds of foreign borrowings in east African countries are denominated in U.S. dollars over the past three years.[41] Accordingly, to estimate the real cost of foreign borrowings, we consider that gP_f in equation (4.2) is the GDP deflator of the United States. Taking the average

[40] See, Kuo et al. (2003)

[41] World Bank, International Debt Statistics

of U.S. annual inflation rates throughout the study period, the gP_f equals to 2%. Table 4.2 presents the long-term public and publicly guaranteed (PPG) external debt and the percentage of that debt contracted in U.S. dollars in EAC countries in 2016.

Table 4.2: The Share of a Public External Long Term Debt Denominated in U.S.D in 2016

Category	Kenya	Rwanda	Tanzania	Uganda
External debt stocks, Long Term Public sector (Mill. USD)	18,997	2,353	13,637	8,775
Currency composition of PPG debt, U.S. dollars (%)	71%	68%	67%	63%

Source: World Bank, International Debt Statistics

Regarding the proportion of foreign financing that is responsive to interest rate changes, World Bank Indicators provide the percentage of concessional debt to total external debt. In all east African countries, concessional debt accounts for the majority of total external debt. Due to the International Monetary Fund (2014), "concessional loans occur when units lend to other units at a contractual interest rate intentionally set below the market interest rate that would otherwise apply". For this analysis, we assume that a non-concessional debt is the loans with a variable interest rate; hence the share of foreign financing that is reacting to market interest rates changes (k) are 30%, 16%, 37%, and 25% in Kenya, Rwanda, Tanzania, and Uganda, respectively.

With the purpose of finding the cost of foreign lending to domestic borrowers (if), we estimate that the interest rate charged on foreign financing would be at least the U.S. treasury long-term rate plus an additional charge for country risk. The U.S. treasury

long-term average nominal interest rate is about 3.06%.[42] Using Damodaran (2019) estimation of country risk premium,[43] we obtained the estimated cost of foreign borrowing for each country net of withholding tax as shown in Table 4.3.[44]

Table 4.3: Foreign Nominal Borrowing Rate in EAC Countries

Category	Kenya	Rwanda	Tanzania	Uganda
U.S. Treasury Long-Term Average Rate*	3.06%	3.06%	3.06%	3.06%
Country Risk Premium (CRP)	5.43%	5.43%	4.44%	5.43%
Foreign nominal borrowing rate (i_f)- (on US loans)	8.49%	8.49%	7.50%	8.49%

Source of U.S. Treasury Long-Term Average Rate data is U.S. Department of the Treasury
* calculated as an annual average based on monthly averaging of U.S. treasury long-term rates in 2018.

The final component required for equation (4.2) is the elasticity of the supply of foreign funds. The elasticity of the supply of foreign funds, as defined by the changes in the stock of foreign financing with respect to interest rate, is applied at 2 in all countries; however, a sensitivity analysis is run to define the effect of changes in this parameter on the marginal economic cost of foreign funds. The finding shows that a

[42] Long term treasury represents a treasury with 25 years or more remaining to maturity. We consider the annual average rate of U.S. treasury long-term in the last year (2018) as we are concerned with the apprising of public project in the future.

[43] We used the country risk premium updated on January 2020.

[44] It is worth to mention here that the average interest rate on loans from World Bank to the East African countries are 8%, 7.2% and 6.5% for Kenya, Tanzania and Uganda, respectively. Furthermore, Gueye & Sy (2015) estimated the interest rate cost of external borrowing from international capital market for Kenya, Rwanda and Uganda would be 7.65%, 9.05% and 7.65 respectively. Another indicator that may reflect the cost of government borrowing from abroad is sovereign bonds issued in US dollars in international market. Information about Eurodollar bonds are collected from DataStream and it shows that Kenya raised $2 billion of 5 years and 10 year Eurobond in 2014 with coupon rates 5.875% and 6.875%. Moreover, in 2018 Kenya issued another $2 billion Eurobond of 10 years and 30 years with coupon rates 7.250% and 8.250%. The governments of Rwanda and Tanzania have 10-year tenors Eurodollar bonds with lending rates at issue for 6.875% and 7.020%, respectively.

change from 1.5 to 2.5 causes a slight change in economic cost of foreign funds of less than one percentage point.

Substitution of the above components in equation (4.2), the real marginal economic cost of foreign borrowing (MC_f) for EAC countries are estimated and shown in the following table.

Table 4.4: Real Marginal Economic Cost of Foreign Borrowing (MC_f)

Category	Kenya	Rwanda	Tanzania	Uganda
Foreign borrowing rate (i_f)	8.49%	8.49%	7.50%	8.49%
Foreign inflation rate (gP_f)	2%	2%	2%	2%
Share of variable interest rate (K)	30%	16%	37%	25%
Supply Elasticity of foreign funds (ε_s^f)	2	2	2	2
Marginal cost of foreign borrowing (MC_f)	7.32%	6.86%	6.39%	7.16%

* For example, Marginal cost of foreign borrowing (MC_f) for Kenya is:
$MC_f = \frac{[8.49\%-2\%]}{1+2\%} * \left[1 + 30\% * \left(\frac{1}{2}\right)\right] = 7.32\%$

4.3.2 Shares of the Three Diverted Funds in Financing the Projects

After we estimated the cost for each of the three components of EOCK, the next step is to assess the weights of each of the three sources of funds. According to Jenkins *et al*. (2019), the weights of each source of funding related to "the average contributions made from each source and their price responsiveness to the change in market interest rate as a result of raising funds for new investment project in the capital market". For empirical estimation, the relevant formulas of Jenkins & Kuo (1998) can be followed:

$$f_1 = \frac{-\eta(\frac{I_t}{S_t})}{\varepsilon_h^s(\frac{S_d}{S_t}) + \varepsilon_f^s(\frac{S_f}{S_t}) - \eta(\frac{I_t}{S_t})} \quad (4.3)$$

$$f_2 = \frac{\varepsilon_h^s(\frac{S_d}{S_t})}{\varepsilon_h^s(\frac{S_d}{S_t}) + \varepsilon_f^s(\frac{S_f}{S_t}) - \eta(\frac{I_t}{S_t})} \quad (4.4)$$

$$f_3 = \frac{\varepsilon_f^s(\frac{S_f}{S_t})}{\varepsilon_h^s(\frac{S_d}{S_t}) + \varepsilon_f^s(\frac{S_f}{S_t}) - \eta(\frac{I_t}{S_t})} \quad (4.5)$$

Where, ε_f^s = the elasticity of the supply of foreign funds; η = elasticity of demand for private investment ε_h^s = supply elasticity of domestic savings; in respond to the interest rate changes. S_t = total private-sector savings available in the economy; S_d = total domestic savings; and S_f = total net foreign capital inflows; I_t = private sector investment.

As noted in the preceding part, the supply elasticity of foreign funds has been set at 2 in all east African countries. Based on Ogaki *et al.'s* (1996) estimations, the average interest sensitivity of savings at an initial real interest rate of 3% was about 0.312 in low-income countries, while it was about 0.532 for the lower-middle-income countries. For this study, we use 0.4 as the supply elasticity of private savings. The interest elasticity of demand for domestic investment is set at -1.0.

The International Monetary Fund (IMF) Government Finance Dataset shows that the general government net lending/borrowing account is negative throughout the study

period in all east African countries with very few exceptions in specific years.[45] Hence, one can say that the major part of domestic savings is private-sector savings, and the private-sector investment in east African countries have been financed by private sector savings. In this regard, we consider (It/St) is the average ratio of private sector investments to private sector savings over the period 1999-2016. All ratios are presented in Table 4.5.

The amount of foreign investment includes the stock of foreign direct investment (FDI) and the stock of long-term external debt. Using the 2016 figures,[46] the total amount of foreign investment at 2014 constant prices was KES 2,579 billion (USD25,409 million) for Kenya, RWF 3,000 billion (USD3,812 million) for Rwanda, and UGX 62,824 billion (USD18,370 million) for Uganda.[47] These amounts were financed From foreign savings. The share of foreign loans' stock to the reproducible capital value is about 12.64%, 11.57%, and 15.83% in Kenya, Rwanda, and Uganda, respectively, and these ratios would represent the contribution of foreign savings to the total private-sector savings (Sf /St). The remaining of these percentages being financed from domestic savings, namely for (S_d /S_t), and are presented in Table 4.5. Regarding to Tanzania, a substantial amount of direct foreign capital investment is expected to be flowing into the country as a result of the increase in mining sector activities. Such inflows of capital do not reflect the actual responsiveness of foreign savers to the

[45] Statistics show that general government of Kenya had a positive balance in 1999, and Uganda had a positive balance in 2004 with +0.6% of GDP and +0.4 of GDP respectively. General government of Rwanda had a positive account on 2004,2005 and 2008 with +2.6, +1.3 and +0.9 of GDP. Tanzanian public sector has been in deficit during the period under investigation.

[46] The data of foreign direct investment were obtained from UNCTAD STAT as an inward stock. While the data of external stock debt (long-term) were obtained from World Bank, International Debt Statistics.

[47] All figures are converted to 2014 prices based on country specific GDP deflator. Official exchange mid-rate on 2016 were obtained from IMF and would be approximately 101.5 Kenyan Shilling per U.S. dollar, 787 Rwandan Franc per U.S. dollar and 3420.10 Ugandan Shilling per U.S. dollar.

change of the capital market conditions in the country. Thus, we consider 15% as the share of market responsive foreign savings to total private saving in the Tanzanian economy.

With these assumptions and rations, the shares of funds drawn from the three resources in order to supply funds to investment projects can be derived. All parameters and the weights of funds for the three alternative sources in each country are presented in Table 4.5.

Table 4.5: Savings, Investment, Elasticities, and Weights for the EOCK Estimation in EAC 1999-2016

Category	**Kenya**	**Rwanda**	**Tanzania**	**Uganda**
Elasticities				
Demand elasticity of domestic investment (η)	-1	-1	-1	-1
Supply elasticity of domestic private savings (ε_h)	0.4	0.4	0.4	0.4
The elasticity of the supply of foreign funds (ε_s^f)	2	2	2	2
Total private-sector savings (S_t)				
Share of domestic savings (S_d/S_t) *	87.4%	88.4%	85%	84.2%
Share of foreign savings (S_f/S_t)	12.6%	11.6%	15%	15.8%
Share of private-sector investment (I_t/S_t) **	85.7%	90%	95%	95%
Weights of sources of funds (f_1, f_2, f_3)				
Displaced domestic private Investment; f_1	59%	60%	60%	59%
Stimulated domestic savings; f_2	24%	24%	21%	21%
Foreign funds; f_3	17%	16%	19%	20%

*(S*d*/S*t*) calculated as [1- (S*f*/S*t*)]
** Private-sector investment (I*t*) represented the private sector's gross fixed capital formation, and we obtained this data from World Bank national accounts data.

4.4 Results and Sensitivity Analysis for EOCK

The EOCK can be obtained as a weighted average gross rate of return of domestic investment and the rate of return to newly stimulated domestic and foreign savings. These rates and the corresponding weights for each one were obtained in the previous sections. By applying equation (4.1) in each country, the results show a small range of 11.66% – 12.84% in the economic discount rate for these four east African countries. The highest figure at 12.84% is for Rwanda, while the lowest rate at 11.66% is for Uganda. The EOCK for Kenya and Tanzania is estimated at 11.69% and 12.63%.

Sensitivity Analysis

In order to determine the impact of changes in the value of the uncertain factors on the estimated value of EOCK for each country, a sensitivity analysis tool can be used.

Although the size of the impact of these factors varies from country to country, the sensitivity analysis confirms that the price elasticity of the demand for domestic investment, foreign borrowing rate, and the supply elasticity of domestic savings are uncertain parameters in the calculation of the EOCK for EAC countries.

i. The price elasticity of the demand for private domestic investment

If the price elasticity of demand for domestic investment is -0.5 instead of the base case value of -1, the share of funds sourced from displaced private investment becomes smaller, and the EOCK would be reduced. On the other hand, if the price elasticity of demand for domestic investment is -1.5, the EOCK will increase owing to the larger share of funds diverted from domestic private investment sources. Table 4.6 shows that all countries reach the lowest EOCK in the extreme cases for all key parameters when the elasticity of demand for domestic investment is -0.5.

Table 4.6: Estimates of EOCK due to Changes in Assumption of Elasticity of Demand for Domestic Investment

Category	Kenya	Rwanda	Tanzania	Uganda
	EOCK	EOCK	EOCK	EOCK
Lower Case (-0.50)	10.29%	11.38%	11.08%	10.46%
Base Case (-1)	11.69%	12.84%	12.63%	11.66%
Upper Case (-1.50)	12.46%	13.63%	13.47%	12.30%

ii. The foreign borrowing rate

When other estimates for cost of foreign borrowing are employed in the range of 2% lower and 2% above the base case, the range of the estimates of EOCK increases or decreases by approximately 0.44 percentage point from the base case estimation in Tanzania and Uganda, and approximately by 0.35 percentage point for Kenya, Rwanda.

iii. Supply elasticity of household savings

If the supply elasticity of savings by households is assumed at 0.2 rather than 0.4 assumed for the base case, the EOCK in EAC countries will increase by 0.70 percentage, 0.63 percentage, 0.56 percentage, and 0.44 percentage in Kenya, Rwanda, Tanzania and Uganda, respectively. However, if this variable is set at 0.6 instead of 0.4, the EOCK will decrease by approximately 0.54 percentage, 0.49 percentage, 0.45 percentage, in Kenya, Rwanda, and Tanzania, but by 0.36 percentage in Uganda.

Table 4.7: Estimates of EOCK due to Changes in Supply Elasticity of Household Savings

Category	Kenya	Rwanda	Tanzania	Uganda
	EOCK	EOCK	EOCK	EOCK
Lower Case (0.20)	12.39%	13.47%	13.19%	12.10%
Base Case (0.40)	11.69%	12.84%	12.63%	11.66%
Upper Case (0.60)	11.15%	12.35%	12.18%	11.30%

Based on the above analysis, we note that the estimates of the ECOK in EAC countries vary from 10.29% to 13.63%. Given the information used in the analysis, the result suggests that the appropriate economic discount rate is 11.5% in Kenya and Uganda, while it is 12.5% for Rwanda and Tanzania. These real rates could usefully be applied to discount annual net economic benefits over the lifetime of an investment project.

4.5 Conclusions and Recommendations

This chapter provides a key economic national parameter for conducting a cost benefit analysis for investment projects in the EAC countries. By applying a consistent method in estimating the appropriate economic discount rates to be used in apprising public projects, policymakers at all levels of government can improve the project selection process of evaluating and choosing public projects as well as the investment allocations to ensure that the highest value projects are chosen and funded in order to achieve more efficient utilization of resources to increase the growth and well-being of their societies.

The weighted average approach has been implemented in this study; this approach takes into consideration the opportunity cost of raising funds in domestic and international capital markets. An increase in the demand for investable funds tightens capital market conditions; consequently, some private domestic investment would be displaced as well as the domestic and foreign savings would be stimulated.

Our findings suggest that the base-case estimate of the real economic opportunity cost of capital in Kenya, Rwanda, Tanzania, and Uganda would be approximately 11.69%, 12.84%, 12.63%, and 11.66%, respectively.

To ensure the robustness of the estimated values, we performed a sensitivity analysis to capture the crucial factors that have an effect on the measurement of the EOCK. The findings indicate that the price elasticity of the demand for private domestic investment, foreign borrowing rate, and the supply elasticity of domestic savings are the important parameters in determining the value of EOCK in all countries. Considering all things, we suggest 11.5% is the real economic discount rate in Kenya and Uganda and 12.5% in Rwanda and Tanzania.

Chapter 5

THE ECONOMIC DISCOUNT RATE: AN EMPIRICAL ESTIMATION FOR GHANA

5.1 Introduction

Following a transparent analytical framework, this chapter aims to estimate the economic discount rate or, equivalently, a discount rate capturing the economic opportunity cost of capital for Ghana. The advantage of this framework is that it can serve as a basis for future adjustments.

To this end, we apply the same approach described in chapter four to do the estimation of the EOCK to be used for appraising all public investment projects conducted in Ghana. International multilateral institutions and many professionals strongly advocate this approach to estimate the appropriate economic discount rate for a country.[48]

Estimates of this parameter depend on Ghana's economic structure and the types and sizes of the market distortions, the economy's performance and the opportunity cost of alternative uses of funds within the public projects.

The remainder of the chapter is organized into three sections. Section 5.2 presents the empirical estimation of the three components of the EOCK and its weights. The EOCK

[48] See, for e.g., Burgess (2013); Burgess & Zerbe (2013).

results and sensitivity analysis for each country are shown in section 5.3. Finally, Section 5.4 contains conclusions and recommendations.

5.2 Empirical Estimation

Following expression (4.1) in chapter four is used to calculate the estimates of the economic opportunity cost of capital (EOCK) for Ghana. The first component required to estimate the EOCK is presented in section 5.2.1. It is concerned with estimating the opportunity cost of the three sources from which the additional demand for funds by government projects can be satisfied. Section 5.2.2 presents the estimation of shares of these three sources of funds.

5.2.1 The Economic Opportunity Cost of the Different Sources of Public Project Funds

5.2.1.1 The Gross of Tax Rate of Return of Private Domestic Investment (ρ) for Ghana

According to the availability of detailed information at different levels in Ghana's national account system, an "aggregate and top-down approach" described in chapter three is adopted in this study to measure the return to domestic investment in Ghana.

The first step is to estimate the labor contribution coefficient to the national income. Ideally, this represents the total public employees' compensation, private wages and salaries paid to the workers by corporations' businesses, and the labor income of the non-incorporated enterprises as well as governments. For the purpose of this study, we used the figures derived from a social accounting matrix (SAM) of Ghana[49]. A national SAM is an economy-wide data framework that refers to a given period that captures a

[49] National and regional SAMs of Ghana have been developed for 2013 and 2015 in collaboration between Institute of Statistical, Social and Economic Research, the Ghana Statistical Services, and International Food Policy Research Institute.

disaggregated country's economic structure. Incomes made by factors during the production process are presented. The total value-added generated by labor in Ghana is GH¢ 31,141 million and GH¢ 43,196 million in 2013 and 2015, respectively. To estimate the share of labor income in GDP, we divided this annual total labor income value by the Ghanaian national income in respective years.[50] The result suggests that the labor income as a percentage of GDP is 33.36% in 2013 and 31.37% in 2015. Based on these values, we use the average of 32.37% for the base case estimate of the contribution of labor. A sensitivity test will be undertaken for this key variable later.

The next component to be excluded is the income generated by unimproved land. As unimproved land is not part of reproducible capital, it is not part of the base of our rate of return estimation. However, land is a production factor that particularly contributes to the agriculture and housing sectors value-added.[51]

Even though the agricultural sector is still the dominant sector with respect to the workforce, its GDP share had significantly decreased from 40.94% in 2005 to 21.22% in 2017.[52] To estimate land's contribution, we need only to consider crop agriculture and livestock as a major input for land. Ghanaian National data indicates that the gross value added by crop agriculture and livestock in the aggregate sector ranges between 77.69% to 86.44%. According to Robles (1997), "the contribution of land is approximately one-third of the total value added of the agriculture sector". Hence, we estimate the land contributions to the GDP as (1/3), multiplying by the portion of the

[50] Ghana's GDP at market prices were GH¢93,349 million and GH¢137,684 million in 2013 and 2015 based on old series national account as 2006 was a base year.

[51] Disaggregated items of the GVA of the agriculture sector is available Ghana. On the other hand, no further disaggregated data are available either on the value-added of housing sector nor on the contribution of land to the sector. Accordingly, in the absence of detailed information, the housing sector is excluded from this study.

[52] GDP statistics published by GSS.

crop and livestock in the aggregate sector times the gross value added of the total agriculture sector as shown in Appendix A.5, Column (6) and (7).[53]

The third component is the natural resource rents that must be deducted from the return to capital as it is not a return to reproducible capital. Natural resources combined with reproducible capital gives rise to economic rents. Mining, such as gold and crude oil, plays a significant role in Ghana's economic activity, particularly from 2011, when Ghana successfully produced crude oil in commercial quantities. The contribution of this sector to employment, exports and GDP has rapidly increased in recent years. The national figures show that the ratio of mining output to GDP in Ghana has increased from 2% in 2010 to 8% in 2011. It was further increased and reached a peak in 2014 with 15% of GDP.

In order to estimate the amount of resource rents created by the mining sector in Ghana, one first needs to examine the ways that the government has tried to appropriate these rents. The government levies royalty rates on the value of the mineral and oil sold plus a further charge on all export sales. In addition, the government receives income from the mining sector through the free equity it has received in exchange for the rights of private investors received to develop the mines. Over the period of this study, the total payments received by the government in the form of mineral royalties and royalties from oil are provided by the Ghana Revenue Authority (GRA). The total royalties constitute about 10.28% of the gross value added by mining sector. In the absence of more precise data, we assume that the value of economic rents in Ghana that need to

[53] Based on this method, the total contribution of land that we excluded from national income is approximately 6.44% over the period 2006 to 2017. This figure reconciles with the share of land rents in GDP available in Ghana's SAMs. SAMs data indicate that the share of value added generated by land relative to GDP are 7.02% in 2013 and 6.09 % in 2015.

be deducted from the national income is only the share of total royalties in the mining sector. However, we expect this estimate to be somewhat underestimated of the share of natural resources as the income received from the free mining equity and the corporate tax on economic rents received by the government are not accounted for in this research.

The fourth part is indirect taxes and subsidies. Indirect taxes mainly include sales tax (i.e., value added tax charged on the sale of goods or services), excise tax and customs duties that are all included in GDP at market prices. To account for the return to reproducible capital, we need to allocate the total amount of indirect taxes between the value added of capital and the value added of labor.

In sales taxes, Ghana is implementing a VAT and National Health Insurance Levy (NHIL) regime at an aggregate rate of 17.5%, including 15% for standard and 2.5% for NHIL. Of the 15%, 2.5% is a Ghana Education Trust Fund Levy (GETFL).[54] These VAT taxes and NHIL are of the 'consumption-type' that apply to the sales of products at all stages of manufacture and distribution. The Ghanaian government allows the vendors full credit for their VAT payments on production inputs and investment goods. Therefore, the value added tax is entirely borne by the value added of labor. Hence, the total tax collections of aggregate VAT have to be excluded from the share of GDP accruing to capital alone.

[54] From August 2018 onwards, Ghana has split out the 2.5% Education Trust Fund levy from the combined current VAT rate at 15%. This means that instead of the current consolidated 15%, the new VAT rate will be 12.5%. The 2.5% Education Trust Fund levy will now be combined with the National Health Levy of 2.5%. The new charge now is called 'Health and Education Levy' with the rate of 5%. Accordingly, the National Health Insurance (Amendment) Act, 2018 (Act 971) has delinked this levy from VAT.

Customs and excise duties are imposed on imported goods at the port of entry and certain manufactured goods produced or imported into Ghana. These include bottled water, malt drink, beer, spirits, cigarettes, and snuff and other tobacco products. The portion of this type of taxation that is a part of the value-added labor should be computed and excluded from the income accruing to reproducible capital. To this end, we apply a similar proportion as the share of labor income in GDP and subtract this amount of taxes from GDP. This is shown in Column (3) of Appendix A.5.

Unlike taxes, subsidies reduce the estimated GDP expressed in market prices. Hence, the share of subsidies on the value added of capital must be added back in order to derive the value added of capital that reflects production costs. In order to do so, we only consider the subsidies on production. Subsequently, a share of subsidies that is attributable to the value added of capital must be added to GDP. Based on fiscal data for the central budgetary government in Ghana[55], we estimated the shares of production subsidies relative to GDP to be approximately 0.37%.

After labor's share of national income and the income accruing to land and natural resource rents, as well as the proportion of indirect taxes attributed to capital income are estimated, the value of depreciation expense needs to be deducted from GDP. The annual values for the depreciation of fixed capital are available through the national accounts data.[56]

[55] Data for subsidies on products are not available for 2009,2011,2016 and 2017.

[56] See, The World Bank, *World Development Indic*ators

The final adjustment is required for the imputed bank service, i.e., intermediation charges. According to GSS, these service charges are excluded from the GDP at the current market price used in calculations. For the purpose of estimating the income to capital, the intermediation charges need to be added back to GDP.

To this point, we have estimated the aggregate income that is directly accruing to reproducible capital throughout the period 2006-2017, i.e., gross-of-tax return to capital; the results are shown in Appendix A.5, Column (11). This income to capital is the remunerative income as captured by the national accounts. The consumer surplus created by public sector investments that reduced costs in the economy is not included in the remunerative income to capital.

In order to determine the real rate of return to capital, the amounts of capital return at current prices must be deflating by the GDP deflator to obtain the capital income in real terms. This step aims to express values for both the capital income and capital stock values at the same price-level. In this chapter, we identify the price level of 2013 as the base year for Ghana.

The reproducible capital stock measures are available at Penn World Table (version .9) based on the perpetual inventory method (PIM). According to Feenstra et al. (2015), the methodology depends on a data set with investment in six assets with their different depreciation rates.[57]

[57] These are the same set of assets described in chapter 3.

The data of reproducible capital stock for Ghana in U.S. dollars is available until 2014; thus, there is a need to complete the estimates of the reproducible capital stock for 2015 to 2017. To this end, we followed the method applied by Gupta et al. (2014), using equation (3.4) in chapter 3.

In order to apply this method, we firstly use the capital stock estimates in the PWT for January 1st, 2005, and January 1st, 2006, and use the mid-point of those years as the amount of capital stock value on mid-2005 and, in the same manner, create a mid-year amount of capital stock from 2005 to 2013. In order to estimate the mid-year capital stock for 2014, 2015, 2016 and 2017, we apply equation (3.4) using the mid-year capital stock in 2013 as the value of the capital stock for the first period (K_{it}) in estimating the capital stock as of July 1, 2014, 2015, 2016 and 2017. All details on the construction of the capital stock series are presented in Appendix B.5.[58]

The final adjustment required to estimate the reproducible capital stocks is to exclude a non-remunerative share of general government investment, such as the investment in roads, schools, and public buildings. The income to capital measured by the national accounts includes only the remunerative monetary returns. It does not measure the augmentation of economic welfare by consumer surplus that arises from the use of public infrastructure where no fees and tariffs are charged.

[58] The depreciation rates of the capital stock were obtained from PWT (V.9) dataset. We used the average depreciation rate at 4.57% to estimate the capital stock in these years.

According to the IMF, Investment and Capital Dataset (ICSD),[59] the average proportion of the private-capital stock plus public-private partnership capital stock is approximately 60% of Ghana's total capital stock during the period 2006-2017.[60]

As we exclude the proportion of general government capital stock[61] that is non-remunerative, these ratios will reflect the proportion of the total capital stock that corresponds to the remunerative capital stock. Accordingly, the capital stock series obtained from PWT are multiplied by these ratios to derive the remunerative capital stock in Ghana.

The real rate of return to capital is estimated as the capital's share of national income during a specific year divided by the reproducible capital stock for that year. For the past twelve years, the result indicates that the aggregate rates of return on capital in Ghana's economy are substantial. The average real rate of return (net of depreciation expense) to domestic investment (ρ) over the study period has been 13.39%.

Figure 5.1 illustrates the estimations of the real rate of return to domestic investment of Ghana from 2006 to 2017, while the return to capital exhibited a steady path between 2006 to 2013, ranging from 14.60 % to 15.35%. The return to capital began to decline from 2014 and recorded the lowest rate in 2017 of 8.8%. This dramatic decline was mainly affected by the country's economic cycle, as Ghana's GDP growth

[59] Total capital stock consists of general government capital stock, private capital stock and public private partnership capital stock.

[60] The Disaggregated data for GFCF in Ghana is available from 2013 to 2018. After we exclude the non-remunerative capital such as residential buildings, construction of roads and railways, and other public construction, the average share of the annual remunerative GFCF is about 60% of the total investment for the period 2013 -2018. This is a good indicator that around 60% of the capital stock computed in PWT can be attributed to the remunerative capital.

[61] Public Investment excludes state-owned enterprises (SOEs) and parastatals. For more details, see Schwartz (2015).

rate of 3.72% in 2016 was a far cry from the record high of 14.05% in 2011 and the lowest in over two decades.

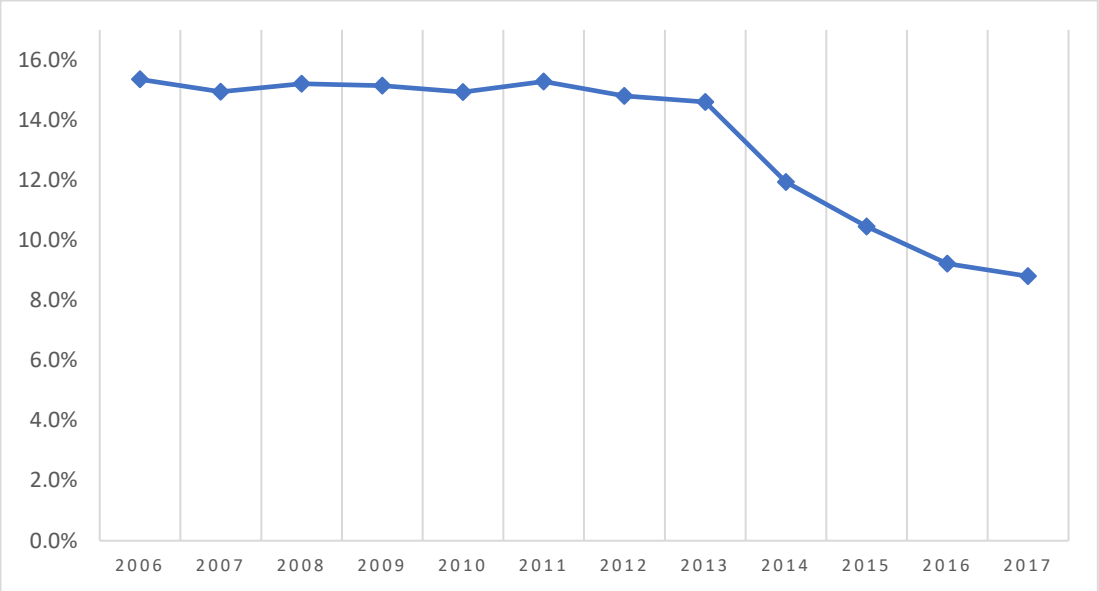


Figure 5.1: Real Rate of Return to Domestic Investment

5.2.1.2 The Rate of Return on Domestic Savings (*r*) in Ghana

The second element in determining the country's economic opportunity cost of capital is the return to newly stimulated domestic savings. As we consider the market to be the source of funds for any investment, the marginal rate of return on additional savings will reflect the marginal value of forgone consumption in calculating the (EOCK). According to Jenkins et al. (2019), "When funds are raised in a country's capital market to finance a new project, it will stimulate private savings in the country's financial institutions". This additional saving represents the forgone household consumption with an economic opportunity cost equal to the net-of-tax rate of return on additional savings.

Following the same methodology presented in section 4.3.1.2 in chapter 4, the net of tax return on domestic savings can be estimated as the return to reproducible capital

(gross of tax) calculated in the preceding section net of the amount of taxes on a corporation's profits, as well as the amount of taxes on personal income generated from the investment. Besides, the property taxes paid by these corporations and householders should be deducted. However, this net of tax income is not what savers will receive because there will be costs associated with the financial intermediation charges by financial institutions that must be deducted from this net of tax income to capital to get to what savers will see as their return from saving. These costs of financial intermediation are an economic resource cost that drives a spread between a gross of tax return of investment (that contains risk premium) and the interest rate charged to borrowers. Afterward, the return on domestic savings should be deflated by the GDP deflator index to obtain the real return on domestic savings, and then divided by the remunerative capital stock to express this variable as the average real rate of return on domestic savings.

Over the study period 2006-2017, the rate of return on domestic savings for Ghana has been calculated on average at 12.42%. All estimations and formulas are provided in Appendix C.5.

One important matter about the above-estimated rate is that the rate of return on domestic savings for a country is supposed to reflect the society's time preference for consumption as a whole, which is expected therefore to be less than the above-estimated rate of return to domestic savers. That is to say, we need to exclude the risk premium involved in the return to different investments with the aim of estimating the society opportunity cost in terms of forgone consumption. For this purpose, we assume that investors' average risk premium is about the value of mid-distance between the above-average estimate of the real rate of 12.42%, which is net of the amount of taxes

on income generated from the investment, and the risk-free rate[62] adjusted for inflation and personal income tax.[63] In order to obtain the social time-preference rate for consumption, the average risk premium needs to be subtracted from the rate of return to domestic savings.[64] Table 5.1 illustrates the calculation of this rate in Ghana that represents (r) in the calculation of EOCK. The final estimates suggest that the rate of return on domestic savings is 8.18% in real terms.

Table 5.1: The Real Rate of Return on Domestic Savings (r)

Category	Rate
Treasury bill (91 days)	17.25%
CPI (YOY%)	13.31%
Real rate of return to risk free bond	3.94%
The real primary rate of return on domestic savings	12.42%
Risk-premium	4.24%
Real rate of return on domestic savings (r)	8.18%

Source: Central Bank of Ghana & calculation
Notes:
1. Treasury bills & CPI % are the average rate from 2006 - 2017.
2. Risk Premium = [Primary Real Rate of Return on Domestic Savings - Real rate of return to risk free bond] / 2
3. Real Rate of Return on Domestic Savings (r) = [Primary Real Rate of Return to Domestic Savings - Risk Premium]

5.2.1.3 The Marginal Economic Cost of Foreign Financing (MC_f) in Ghana

The marginal cost of foreign borrowing is the third element we need for the estimation of the EOCK. In an open economy, when the government accesses the world capital market, raising funds stimulates the savings of foreigners to inflow into the economy.

[62] Treasury bills are widely applied as a risk-free financial security.

[63] Interest paid to an individual on government bonds in Ghana is not taxable.

[64] In any society the population of investors will have a wide distributed degree of risk aversion. Some will be very risk averse and prefer to invest in treasury bills while the other extreme are those who have a zero aversion to risk. Other investors are assumed to be distributed linearly between these two extremes.

Due to country risk, an increase in the demand for investable funds will augment the market interest rate, facing a country seeking additional supplies of foreign funds. Besides this higher interest rate charged on the additional loans due to the country risk premium increase, it will also be accounted for all existing debt contracted based on the variable interest rate.[65] The marginal cost of foreign borrowing created by the projects can be calculated using formula (4.2) in chapter 4.

According to the World Bank, International Debt Statistics, the outstanding amount of long-term external debts of Ghana was at 17,566.11 million US dollars in 2017, all of which was held by public and publicly guaranteed institutions. The data's currency composition shows that the US dollar-denominated long-term debt accounts for 78.62% of the total[66]. Accordingly, we consider that gP_f in equation (6) is the GDP deflator of the United States. Taking the average of U.S. annual inflation rates throughout the study period, the gP_f equals 2%.

The Annual Public Debt Report (2017) provides details on the composition of external debt by creditor category. The report shows that commercial debt constitutes the largest foreign debt in 2017, with about 46.9% of the total foreign debt portfolio. The number of outstanding Eurobonds borrowed from the international capital market accounted for 21.43% of commercial debt stock. The residual share of total foreign debt comes from bilateral and multilateral sources. Multilateral debt, which is mostly

[65] See, e.g., Jenkins, Kuo, & Harberger (2011).

[66] According to the World Bank, International Debt Statistics, around 9% of the long-term external debt in 2017 is denominated in Euro, and 3.4% in Special Drawing Rights (SDR). The rest is in other currencies.

on concessional terms, constituted 37.5% of foreign debt, while bilateral debt accounted for about 15.6%.

In terms of the interest structure of external debt, statistics show that near 79.7% of external debt is contracted on a fixed interest rate basis. In comparison, the floating rate and interest free debt represent 19.1% and 1.2% of the external debt, respectively. Over the last three years, the variable interest rate accounts for around 19.4% of the total external debt. For this analysis, the share of foreign borrowing responsive to interest rate changes (k) is assumed at 20%.

In order to choose the cost of government borrowing from abroad (i_f), we suggest considering the interest rate charged on foreign financing would be the U.S. treasury long-term rate plus additional charges for country risk. The U.S. treasury long-term average rate is about 3.02%.[67] Damodaran's (2018) estimation of countries' risk premiums suggests that the Country Risk Premium (CRP) for Ghana is 9.03%.[68] Hence the foreign borrowing rate net of withholding tax in Ghana would be 12.05%.[69]

The last component required for equation (4.2) is the elasticity of the supply of foreign funds with respect to the interest rate. This variable is set at 2; however, a sensitivity test has been undertaken to define the effect of changes in this parameter on the marginal economic cost of foreign funds. The finding shows that a change from 1.5 to

[67] Long term treasury represents a treasury with 25 years or more remaining to maturity. We consider the annual average rate of U.S. treasury long-term in the last year (2018) as we concern with the apprising of public project in the future.

[68] We used the country risk premium updated on January 2019.

[69] The withholding tax rate applicable to payments of interest to non-residents is 8%. See, http://taxsummaries.pwc.com/ID/Ghana-Corporate-Withholding-taxes

2.5 causes a slight change in economic cost of foreign funds with less than half percentage point. Substitution the parameters and assumptions describe in equation (4.2), the estimate of the real marginal economic cost of foreign financing (MC_f) for Ghana is at 10.84%.

5.2.2 Shares of the Three Diverted Funds in Financing the Projects

The next step after the estimation of the three components is to estimate the proportion of each of the three sources of project funds. For empirical estimation, we follow Jenkins & Kuo (1998) formulas described in chapter 4, i.e., equations (4.3), (4.4) and (4.5).

As mentioned in chapter 4, the supply elasticity of foreign funds has been set at 2. Concerning the supply elasticity of domestic savings, we use the same value of 0.4 as applied in EAC countries. The price elasticity of the demand for private domestic investment in response to the interest rate is -1.

According to recent available data in Ghana's SAM (2015), the total domestic private savings (St) was GH¢ 41,557 million on which GH¢ 3,803 million is domestic savings by enterprises, GH¢ 29,111 million household savings, and GH¢ 8,642 million is foreign savings. The figures also show that the Ghanaian government's recurrent fiscal deficit is GH¢ (-3,053.33) million in the same year.[70] According to the above data, we can estimate the contribution of household savings to the total private–sector saving (Sd /St) at 70% and the contribution of foreign savings as a share of the private-sector

[70] This is the difference between revenues and recurrent costs i.e., before public capital investment.

savings (Sf /St) at 21%. The total private sector investment ratio to total savings (It/St) is about 0.69.[71]

With these rations and assumptions, the shares of funds diverted from the three sources described above can be derived. They are 49.89% from displaced or postponed domestic investment, 29.94% from additional foreign Capital Inflows, and 20.17% from household (domestic) savings.

5.3 Estimates for the EOCK

The estimation of EOCK now is carried out as a weighted average rate of return to displaced private investment and the rate of return on domestic and foreign savings. These rates and the corresponding weight for each one are obtained in the previous sections. By applying equation (4.1), the economic discount rate of Ghana is estimated at 11.57%.

Sensitivity Analysis for the EOCK

A sensitivity analysis with different ranges of tested values is run to evaluate the effect of variations in key parameters. The result suggests that Labor's share of national income and the percentage of capital stock be attributed to remunerative capital are an important parameter in determining the EOCK in Ghana.

[71] The annual GFCF- private sector data received from MoF of Ghana over the period 2013-2018 are based on the revised national accounts statistics made by Ghana Statistical Service (GSS) for the period 2006 to 2013. However, total domestic private savings available in SAM (2015) is measured in prices of 2006. Therefore, calculating the ratio of (It/St) based on different year bases will lead to incorrect result. To get control of this, the data available at indexmundi till 2013 indicate that the GFCF - Private sector measured in prices of 2006 is GH¢19.73 billion in 2013. According to Ghana's SAM (2013), the total private-sector savings (St) is GH¢ 28.47 billion.

i. The Share of Labor Income in GDP

We have estimated a value of 32.37% for the income accruing to labor as a percentage of GDP in the base case. Suppose this ratio is as low as 28.37%; the EOCK would be raised on average to 12.33%. However, if the share of labor in GDP increases by 4 percent above the base case, the EOCK would be at 10.82%.

ii. The Percentage of Capital Stock being Attributed to the Remunerative Capital

The sensitivity analysis result illustrates how the EOCK in Ghana varies when another extreme assumption is made for the percentage of capital stock attributed to the remunerative capital in the range of 10% lower and above the base case. The base case of the remunerative share of capital stock for Ghana is 60%. If this portion moves downward to 50% of capital stock, the average EOCK rises from the base case of 11.57% to 13.16%. On the other hand, if the share of a remunerative portion is higher at 70%, the EOCK would be reduced to 10.44%.

In view of this sensitivity analysis, we observe that the value of EOCK ranges from 10.44% to 13.16%. The mean value of the sensitivity results plus the base case suggests that the EOCK is 11.66%. Given the information used in the analysis, the work suggests that the appropriate economic discount rate to be applied usefully in the CBA of Ghanaian projects is 11.5%.

5.4 Concluding Remarks

This chapter has applied a practical approach to estimate the economic opportunity cost of capital for Ghana. This national economic parameter plays a crucial role in evaluating the economic net present value criterion for selecting Ghana's investment projects.

The methodology applied to measure the economic opportunity cost of capital in this chapter is the weighted-average cost of capital. This method takes into consideration the opportunity cost of sourcing funds from the domestic and international capital markets to finance an investment project. An increase in the demand for investable funds drives the market interest rate up; consequently, some private domestic investment would be displaced as well as the domestic and foreign savings would be stimulated. Applying this method, the base-case estimate of the economic discount rate is 11.57%.

To ensure the robustness of the estimated values, we performed a sensitivity analysis test by allowing the crucial parameters that impact the economic discount rate measurement. The results indicate that the range of economic discount rate fluctuates between10.08% and 12.85% in real terms. Consequently, we recommend that an 11.50% rate is an appropriate discount rate in discounting the project's flows of economic costs and benefits over time.

The estimation of the EOCK for Ghana has been challenging in terms of data availability. Nevertheless, the methodological approach employed in the study is sound. The empirical work with different sensitivity analyses demonstrates the robustness of economic discount rates being applied for the economic evaluation of public and private investment projects in Ghana.

Chapter 6

CONCLUSION

This thesis aims to estimate the rate of return to capital and the economic opportunity cost of capital to be used in the appraisal of public projects in EAC countries and Ghana.

To achieve the objective of this thesis, we initially focused on calculating the rates of return on capital for EAC countries in chapter 3. Then, we used these results with additional information to calculate the economic opportunity cost of capital in chapter 4. This analysis was done after exploring the theoretical foundations and the empirical aspects surrounding this concept in detail. In chapter 5, following the same methodology, we estimate the EOCK for Ghana.

More specifically, in chapter three, we basically use EAC's national accounts data. The real rate of return to capital was estimated as the ratio of the income accruing capital to the reproducible and remunerative capital stock. The findings reported indicate that the real rates of return on reproducible capital over the period 1999 –2016 have averaged 10.70% in Kenya and Rwanda, while they averaged 12.05% and 9.86% in Tanzania and Uganda, respectively. With regard to the marginal rates of return to remunerative capital, the results suggest that EAC countries have averaged 16.28%, 16.21%, 15.07%, and 14.49% in Tanzania, Rwanda, Kenya, and Uganda, respectively, over the same period.

The estimated marginal rates of return to capital were subsequently used as a key variable in computing the economic opportunity cost of capital estimated in chapter four.

To enhance efficiencies in the government's use of capital and to keep the growth effect more persistent in these countries, the economic opportunity cost of capital plays a vital role as a discount rate applying for the economic analysis to assess the viability of public investment projects. This rate indicates the cost created in the economy whenever the government increases the demand for funds in the capital markets to finance an investment project. The costs generated in the economy take the form of the private domestic investment displaced, forgone consumption, and paying for incremental funding from abroad. Any public investments yielding economic returns lower than the opportunity costs of funds are economically non-viable and can reduce output and productivity growth as the resources they employ would have made a higher benefit elsewhere in the economy.

In order to estimate the EOCK, the social cost of newly stimulated domestic savings and the marginal economic cost of foreign borrowing were also estimated. Using the weighted average method, the results suggest that the appropriate estimates of the economic discount rate are: 11.5% for Kenya and Uganda, and 12.5% for Rwanda and Tanzania.

In chapter five, we estimated the economic discount rate for Ghana at 11.5% by applying the same approach. The practical application of this parameter in the economic analysis of Ghana's public projects help to ensure that its resources are

optimally utilized, where investments are made in high return projects that would help attain the country's targets as set out in its development strategy.

Considering the types and size of distortions in the markets, the economy's performance, and the true opportunity cost of resources used to fund the projects in these countries, it is considered convenient to apply the findings discount rates in this study to calculate the economic NPV when evaluating projects.

The empirical basis for having a significant discount rate higher than 10% in Africa is the right answer. This study shows that over a long period of time and in a range of countries on the continent, all answers are higher than 10%.

These high rates are consistent with all international institutions' discount rates for evaluating projects in low and middle-income economies. For example, the World Bank has historically adopted a real rate between 10-12% as the economic discount rate for CBA in this region. The African Development Bank (AfDB) also assumes a discount rate between 10 and 12% for economic analysis for all projects in all African countries. Similarly, the USAID CBA Guidelines recommend that a discount rate of 12% be used to appraise economic benefits and costs in general, and a 10% social discount rate for education projects implemented in low and middle-income economies. (Walls *et al.*, 2020).

Given the limited investment resources available in these countries and all infrastructure shortages, this high cut off makes inferior projects very unlikely and leads governments to target high yield investment projects to enhance the impact on their societies.

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APPENDICES

Appendix A: Return to Capital

A .1 Return to Capital in Kenya, 1999-2016 (billions of KES)

	Expressed in Current Prices									Expressed at 2014 Prices					
Year	GDP	Total Labor Income	Taxes on Products	VAT	Subsidies on Products	GVA by AFF	Share of Crop & Livestock in AFF	Depreciation expense	Gross-of-tax Return to Capital	GDP-Def (2009=100)	Real Return to Capital	Reproducible Capital Stock	Remunerative capital stock	Real Rate of Return to reproducible Capital	Real Rate of Return to remunerative Capital
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1999	907	357	57	41	5	261	94%	138	271	0.45	849	8,392	5,959	10.11%	14.24%
2000	968	381	57	50	6	282	94%	148	283	0.48	836	8,686	6,167	9.62%	13.55%
2001	1,020	401	54	51	6	284	94%	153	309	0.48	900	8,948	6,353	10.05%	14.16%
2002	1,035	407	54	56	6	268	93%	158	314	0.49	905	9,168	6,509	9.87%	13.90%
2003	1,132	445	64	60	7	293	94%	175	340	0.52	922	9,396	6,671	9.81%	13.81%
2004	1,274	501	75	76	7	318	94%	194	379	0.56	961	9,727	6,906	9.88%	13.91%
2005	1,416	557	85	78	8	349	94%	205	440	0.58	1,062	10,178	7,226	10.43%	14.69%
2006	1,862	733	102	91	11	388	96%	254	628	0.72	1,228	10,705	7,600	11.47%	16.15%
2007	2,151	846	108	112	12	404	94%	284	749	0.78	1,353	11,252	7,989	12.03%	16.94%
2008	2,483	977	119	127	14	480	95%	320	872	0.90	1,368	11,789	8,370	11.61%	16.35%
2009	2,864	1,127	131	142	16	565	95%	367	1,010	1.00	1,420	12,409	8,811	11.44%	16.12%
2010	3,169	1,247	151	174	18	561	94%	405	1,122	1.02	1,545	13,120	9,315	11.77%	16.58%
2011	3,726	1,466	172	205	21	741	95%	458	1,310	1.13	1,629	13,912	9,877	11.71%	16.49%
2012	4,255	1,674	191	232	24	892	97%	516	1,487	1.24	1,692	14,760	10,480	11.47%	16.15%
2013	4,745	1,867	196	233	27	1,255	92%	562	1,643	1.30	1,775	15,661	11,119	11.34%	15.97%
2014	5,403	2,125	217	260	31	1,483	93%	730	1,768	1.41	1,768	16,969	12,048	10.42%	14.67%
2015	6,284	2,472	244	289	36	1,897	94%	819	2,043	1.55	1,857	18,806	13,352	9.87%	13.90%
2016	7,194	2,830	278	339	41	2,312	95%	862	2,357	1.67	1,981	20,401	14,485	9.71%	13.68%
													Average	**10.70%**	**15.07%**

Sources & Notes:

Column (1), (3), (4), (5), (6) and (7) are obtained from Kenya National Bureau of Statistics.

Column (8) and (10) are obtained from World Bank, national accounts data.

Column (2) = (1) * 0.3934

Column (9) = (1) – (2) – (4) – (6) *(7) *0.33 – (3) *0.3934 + (5) *0.6066 – (8).

Column (11) is the adjusted values of column (9) for GDP- deflator at basic year 2009 & expressed in 2014 price.

Column (12) is obtained from Appendix B.1.

Column (13) = (12) * 0.71

Column (14) = (11) / (12)

Column (15) = (11) / (13)

Abbreviations: GVA: Gross Value Added; AFF: Agriculture, Forestry & Fishing

A .2 Return to Capital in Rwanda, 1999-2016 (billions of RWF)

	Expressed in Current Prices									Expressed at 2014 Prices					
Year	GDP	Total Labor Income	Taxes on Products	VAT	Subsidies on Products	GVA by AFF	Share of Crop & Livestock in AFF	Depreciation expense	Gross-of-tax Return to Capital	GDP-Def (2014=100)	Real Return to Capital	Reproducible Capital Stock	Remunerative capital stock	Real Rate of Return to reproducible Capital	Real Rate of Return to remunerative Capital
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1999	607	206	29	13	3	227	95%	59	249	0.35	713	7222	4767	9.87%	14.95%
2000	676	230	30	14	3	251	96%	66	279	0.36	776	7534	4972	10.30%	15.61%
2001	742	252	28	24	4	277	95%	73	299	0.36	822	7856	5185	10.46%	15.85%
2002	797	271	31	30	5	282	94%	77	324	0.35	940	8216	5423	11.44%	17.33%
2003	993	338	38	38	6	380	95%	101	388	0.42	923	8626	5693	10.70%	16.21%
2004	1206	410	46	47	10	465	93%	123	474	0.48	997	9123	6021	10.93%	16.56%
2005	1440	490	52	58	14	553	93%	149	566	0.52	1091	9749	6434	11.20%	16.96%
2006	1739	591	60	67	19	592	72%	183	749	0.57	1305	10590	6990	12.32%	18.67%
2007	2092	711	68	85	28	635	73%	244	895	0.64	1395	11789	7780	11.84%	17.93%
2008	2658	904	83	117	35	753	70%	310	1147	0.73	1565	13183	8701	11.87%	17.99%
2009	3057	1039	98	125	43	896	72%	366	1308	0.79	1649	14601	9637	11.29%	17.11%
2010	3366	1144	109	132	50	949	73%	406	1453	0.81	1784	16126	10643	11.07%	16.77%
2011	3940	1340	139	159	59	1112	73%	473	1692	0.88	1919	17940	11840	10.69%	16.20%
2012	4506	1532	149	186	63	1317	75%	560	1893	0.93	2039	20039	13226	10.17%	15.42%
2013	4929	1676	162	217	66	1424	76%	635	2034	0.97	2096	22287	14709	9.40%	14.25%
2014	5466	1858	186	257	73	1572	77%	718	2217	1.00	2217	23481	15498	9.44%	14.31%
2015	5968	2029	213	282	80	1671	78%	803	2408	1.00	2401	24052	15874	9.98%	15.13%
2016	6672	2268	252	316	83	1956	80%	914	2628	1.06	2484	25942	17122	9.57%	14.51%
													Average	**10.70%**	**16.21%**

Sources & Notes:

Column (1), (6) and (7) are obtained from National Institute of Statistics of Rwanda (NISR).

Column (8) and (10) are obtained from World Bank, national accounts data.

Column (3) and (4) are obtained from Rwanda Revenue Authority (RRA) & Government Finance Statistics (GFS) – IMF

Column (5) is obtained from Ministry of Finance and Economic Planning (Rwanda).

Column (2) = (1) * 0.34

Column (9) = (1) – (2) – (4) – (6) *(7) *0.33 – (3) *0.34 + (5) *0.66 – (8).

Column (11) is the adjusted values of column (9) for GDP- deflator at basic year 2014 & expressed in 2014 price.

Column (12) is obtained from Appendix B.2.

Column (13) = (12) * 0.66

Column (14) = (11) / (12)

Column (15) = (11) / (13)

Abbreviations: GVA: Gross Value Added; AFF: Agriculture, Forestry & Fishing

A .3 Return to Capital in Tanzania, 1999-2016 (billions of TZS)

	Expressed in Current Prices										Expressed at 2014 Prices					
Year	GDP	Total Labor Income	Taxes on Products	VAT	Subsidies on Products	GVA by AFF	Share of Crop & Livestock in AFF	Depreciation expense	Mining and Quarrying	Gross-of-tax Return to Capital	GDP-Def (2007=100)	Real Return to Capital	Reproducible Capital Stock	Remunerative capital stock	Real Rate of Return to reproducible Capital	Real Rate of Return to remunerative Capital
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1999	7,223	2,788	190	236	7	2,181	91%	778	99	2,690	0.46	11,428	110,810	81,999	10.31%	13.94%
2000	8,153	3,147	217	267	8	2,407	91%	913	119	3,015	0.49	11,906	111,514	82,521	10.68%	14.43%
2001	9,100	3,513	256	322	9	2,636	91%	1,042	160	3,322	0.52	12,459	113,061	83,665	11.02%	14.89%
2002	10,445	4,032	277	388	10	2,988	92%	1,149	220	3,852	0.55	13,487	115,765	85,666	11.65%	15.74%
2003	12,107	4,673	320	466	12	3,480	92%	1,239	288	4,529	0.60	14,623	120,187	88,939	12.17%	16.44%
2004	13,972	5,393	358	586	14	4,116	92%	1,397	357	5,182	0.64	15,634	126,555	93,650	12.35%	16.69%
2005	19,113	7,378	363	773	19	5,469	87%	2,047	609	7,165	0.81	17,093	134,577	99,587	12.70%	17.16%
2006	23,298	8,993	577	838	23	6,766	87%	2,409	934	8,826	0.94	18,077	144,164	106,681	12.54%	16.95%
2007	26,770	10,333	845	991	27	7,181	85%	2,759	935	10,274	1.00	19,865	156,175	115,570	12.72%	17.19%
2008	32,765	12,647	921	1,260	33	9,433	86%	3,081	991	12,687	1.16	21,157	169,429	125,377	12.49%	16.87%
2009	37,727	14,563	1,223	1,346	38	11,408	85%	3,453	1,073	14,625	1.27	22,322	182,484	135,038	12.23%	16.53%
2010	43,836	16,921	1,489	1,568	44	13,110	86%	3,713	1,780	17,213	1.38	24,048	198,540	146,919	12.11%	16.37%
2011	52,763	20,366	1,894	1,762	53	15,488	86%	3,997	2,689	21,320	1.54	26,703	217,493	160,945	12.28%	16.59%
2012	61,434	23,714	1,968	2,178	61	19,096	85%	4,309	3,001	24,886	1.71	28,146	236,880	175,292	11.88%	16.06%
2013	70,953	27,388	2,406	2,441	71	22,129	82%	4,675	2,986	29,271	1.84	30,746	257,157	190,296	11.96%	16.16%
2014	79,718	30,771	3,058	2,285	80	22,969	81%	5,143	2,923	33,955	1.93	33,955	267,828	198,193	12.68%	17.13%
2015	90,864	35,073	3,615	2,556	91	26,347	81%	6,582	3,660	37,944	2.06	35,611	283,693	209,933	12.55%	16.96%
2016	103,169	39,823	4,200	3,494	103	30,160	80%	7,467	4,976	42,439	2.19	37,519	298,891	221,179	12.55%	16.96%
														Average	**12.05%**	**16.28%**

Sources & Notes:

Column (1), (6), (7) and (9) are obtained from Tanzania National Bureau of Statistics (TNBS).
Column (8) and (11) are obtained from World Bank, national accounts data.
Column (3) and (4) are obtained from Tanzania Revenue Authority (TRA)
Column (5) is obtained from Government Finance Statistics (GFS) - IMF
Column (2) = (1) * 0.3860
Column (10) = (1) – (2) – (4) – (6) *(7) *0.33 – (3) *0.3860 + (5) *0.6140 – (8) - (9) *0.09
Column (12) is the adjusted values of column (10) for GDP- deflator at basic year 2007 & expressed in 2014 price.
Column (13) is obtained from Appendix B.3.
Column (14) = (13) * 0.74
Column (15) = (12) / (13)
Column (16) = (12) / (14)

Abbreviations: GVA: Gross Value Added; AFF: Agriculture, Forestry & Fishing

A .4 Return to Capital in Uganda, 1999-2016 (billions of UGX)

	Expressed in Current Prices									Expressed at 2014 Prices					
Year	GDP	Total Labor Income	Taxes on Products	VAT	Subsidies on Products	GVA by AFF	Share of Crop & Livestock in AFF	Depreciation expense	Gross-of-tax Return to Capital	GDP-Def (2010=100)	Real Return to Capital	Reproducible Capital Stock	Remunerative capital stock	Real Rate of Return to reproducible Capital	Real Rate of Return to remunerative Capital
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1999	10,346	3,518	434	343	20	3,574	82%	1,715	3,669	0.49	10,234	94,763	64,439	10.80%	15.88%
2000	11,144	3,789	466	374	22	3,843	82%	1,838	3,963	0.54	9,948	101,527	69,039	9.80%	14.41%
2001	12,368	4,205	479	432	24	3,406	78%	1,972	4,737	0.57	11,373	108,929	74,072	10.44%	15.35%
2002	13,320	4,529	522	495	26	4,095	80%	2,123	4,931	0.55	12,228	117,302	79,765	10.42%	15.33%
2003	15,380	5,229	581	574	30	4,474	79%	2,299	5,936	0.59	13,654	127,009	86,366	10.75%	15.81%
2004	16,966	5,769	649	665	33	5,271	80%	2,513	6,429	0.69	12,793	138,867	94,430	9.21%	13.55%
2005	19,862	6,753	795	782	38	5,695	80%	2,766	7,821	0.68	15,841	152,813	103,913	10.37%	15.24%
2006	22,404	7,617	964	925	43	6,145	77%	3,055	8,942	0.69	17,685	168,762	114,758	10.48%	15.41%
2007	25,943	8,821	1,169	1,136	50	6,972	76%	3,426	10,448	0.74	19,254	189,279	128,710	10.17%	14.96%
2008	31,304	10,643	1,315	1,290	61	9,168	79%	3,878	12,684	0.79	21,975	214,268	145,702	10.26%	15.08%
2009	38,683	13,152	1,417	1,435	75	10,745	80%	4,353	16,478	0.90	24,918	240,517	163,552	10.36%	15.24%
2010	43,123	14,662	1,677	1,711	83	11,749	78%	4,866	18,361	1.00	25,113	268,848	182,817	9.34%	13.74%
2011	55,143	18,749	1,932	2,088	107	15,428	77%	5,415	24,360	1.05	31,843	299,191	203,450	10.64%	15.65%
2012	61,373	20,867	2,004	2,534	119	16,241	76%	5,964	27,312	1.27	29,378	329,523	224,075	8.92%	13.11%
2013	66,764	22,700	2,432	2,758	129	17,371	77%	6,508	29,650	1.32	30,660	359,565	244,504	8.53%	12.54%
2014	72,660	24,705	2,874	3,294	141	18,350	77%	6,693	32,448	1.37	32,448	369,785	251,454	8.77%	12.90%
2015	81,688	27,774	3,240	3,725	158	19,655	77%	7,003	37,213	1.44	35,440	386,905	263,096	9.16%	13.47%
2016	86,555	29,429	3,712	4,080	167	22,545	79%	7,182	38,809	1.49	35,701	396,800	269,824	9.00%	13.23%
													Average	**9.86%**	**14.49%**

Sources & Notes:

Column (1), (6) and (7) are obtained from Uganda Bureau of Statistics (UBOS).
Column (3) and (4) are obtained from Uganda Revenue Authority (URA)
Column (5) is obtained from Government Finance Statistics (GFS) – IMF
Column (10) is obtained from World Bank, national accounts data.
Column (2) = (1) * 0.34
Column (8) = (12) * depreciation rate equals to 1.81%
Column (9) = (1) – (2) – (4) – (6) *(7) *0.33 – (3) *0.34 + (5) *0.66 – (8).
Column (11) is the adjusted values of column (9) for GDP- deflator at basic year 2010 & expressed in 2014 price.
Column (12) is obtained from Appendix B.4.
Column (13) = (12) * 0.68
Column (14) = (11) / (12)
Column (15) = (11) / (13)

Abbreviations: GVA: Gross Value Added; AFF: Agriculture, Forestry & Fishing

A.5: Return to Domestic Investment in Ghana, 2006 - 2017 (billions GHS)																
Expressed in Current Prices												Constant Prices (2013 billion GHS)				
Fiscal Year	GDP	Total Labor Income	Taxes on Products	VAT	Subsidies on Products	GVA by AFF	Share of Crop & Livestock in AFF	Dep. Expense	Natural Resource Rents	FISIM	Gross-of-tax Return to Capital	GDP Def Index (2013=100)	Real Return to Capital	Reproducible Capital Stock	Remunerative capital stock	Real Rate of Return to remunerative Capital
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
2006	24.69	7.99	0.89	0.75	0.09	6.98	78.13%	2.60	0.04	0.41	11.69	0.38	30.67	333.01	199.81	15.35%
2007	30.56	9.89	1.09	1.04	0.11	8.15	77.69%	3.53	0.05	0.50	14.19	0.44	32.17	358.74	215.24	14.94%
2008	39.84	12.89	1.19	1.32	0.15	11.43	79.34%	4.88	0.08	0.69	18.08	0.52	34.98	383.52	230.11	15.20%
2009	48.31	15.64	1.18	1.62	0.18	14.47	80.71%	6.02	0.12	1.19	21.99	0.59	37.24	409.79	245.87	15.14%
2010	60.78	19.67	1.66	1.96	0.22	16.45	79.74%	7.91	0.18	1.51	27.85	0.69	40.49	451.97	271.18	14.93%
2011	78.96	25.56	2.26	2.75	0.29	18.20	82.33%	10.12	0.51	1.46	36.01	0.77	46.68	509.30	305.58	15.27%
2012	99.42	32.18	2.85	3.49	0.37	21.30	82.11%	14.12	0.74	2.32	44.75	0.89	50.52	568.82	341.29	14.80%
2013	123.65	40.03	3.20	3.96	0.46	25.29	84.68%	19.70	1.40	2.92	53.70	1.00	53.70	613.07	367.84	14.60%
2014	155.43	50.31	4.07	5.54	0.58	31.09	84.31%	26.34	2.69	4.35	65.33	1.22	53.47	746.85	448.11	11.93%
2015	180.40	58.40	6.10	6.77	0.67	36.53	83.59%	33.78	2.26	5.47	73.07	1.39	52.66	839.90	503.94	10.45%
2016	215.08	69.62	8.37	7.81	0.80	45.12	85.85%	43.11	2.05	6.72	84.25	1.60	52.68	952.09	571.26	9.22%
2017	256.67	83.08	8.90	9.76	0.95	50.55	86.44%	56.09	3.05	8.14	96.16	1.76	54.49	1,031.90	619.14	8.80%
															Average	**13.39%**

Sources & Notes:
Column (1), (6), (7), and (10) are obtained from Ghana Statistical Services (GSS)
Column (2) = (1) * 0.3237
Column (3), (4) and (5) are obtained from Ghana Ministry of Finance and Ghana Revenue Authority.
Column (8) is obtained from World Bank, national accounts data.
Columns (9) is the shares of mineral royalties and royalties from oil in Mining and Quarrying sector. Sources: GVA by Mining and Quarrying from GSS. Total royalties from G.MoF
Column (11) = (1) – (2) – (4) – (6) *(7) *0.33 – (3) *0.3237+ (5) *0.6763 – (8) – (9) + (10)
Column (12) is obtained from International Monetary Fund, World Economic Outlook 2019
Column (13) is the adjusted values of column (11) for GDP- deflator at basic year 2013.
Column (14) is obtained from Appendix B.
Column (15) = (14) * 0.60
Column (16) = (13) / (15)

Abbreviations: GVA: Gross Value Added; AFF: Agriculture, Forestry & Fishing; FISIM: Financial Intermediation Services Indirectly Measured.

Appendix B: Estimates of Total Capital Stocks

Appendix B.1 Estimates of Total Capital Stocks in Kenya 1999-2016							
Fiscal Year	Capital Stock (Constant,2011 US$ Billion)	Official Exch. Mid-Rate (KES /US$)	GDP Deflator Index (2009=100)	1 + Δ GDP deflator	GFCF (Billions of KES)	Mid-Year Amount of Stocks (Constant,2011 US$ Billion)	Mid-Year Amount of Stocks (Billions of KES - 2014)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-Jan-99	148	70.33	0.45	1.06	0.14	150	8,392
1-Jan-00	153	76.18	0.48	1.02	0.16	156	8,686
1-Jan-01	158	78.56	0.48	1.01	0.19	160	8,948
1-Jan-02	162	78.75	0.49	1.06	0.18	164	9,168
1-Jan-03	166	75.94	0.52	1.07	0.18	168	9,396
1-Jan-04	171	79.17	0.56	1.05	0.21	174	9,727
1-Jan-05	178	75.55	0.58	1.24	0.26	182	10,178
1-Jan-06	187	72.10	0.72	1.08	0.36	192	10,705
1-Jan-07	197	67.32	0.78	1.15	0.43	202	11,252
1-Jan-08	206	69.18	0.90	1.12	0.47	211	11,789
1-Jan-09	216	77.35	1.00	1.02	0.53	222	12,409
1-Jan-10	228	79.23	1.02	1.11	0.65	235	13,120
1-Jan-11	241	88.81	1.13	1.09	0.76	249	13,912
1-Jan-12	257	84.53	1.24	1.05	0.90	264	14,760
1-Jan-13	272	86.12	1.30	1.08	0.98	280	15,661
1-Jan-14	289	87.92	1.41	1.10	1.24	304	16,969
1-Jan-15	-	98.18	1.55	1.08	1.36	337	18,806
1-Jan-16	-	101.50	1.67	1.03	1.24	365	20,401

Appendix B.2 Estimates of Total Capital Stocks in Rwanda 1999-2016							
Fiscal Year	Capital Stock (Constant,2011 US$ Billion)	Official Exch. Mid-Rate (RWF /US$)	GDP Deflator Index (2014=100)	1 + Δ GDP deflator	GFCF (Billions of RWF)	Mid-Year Amount of Stocks (Constant,2011 US$ Billion)	Mid-Year Amount of Stocks (Billions of RWF - 2014)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-Jan-99	10.39	334.00	0.35	1.03	80.00	10.62	7,222
1-Jan-00	10.85	390.00	0.36	1.01	90.00	11.08	7,534
1-Jan-01	11.30	443.00	0.36	0.95	102.00	11.55	7,856
1-Jan-02	11.80	475.00	0.35	1.22	108.00	12.08	8,216
1-Jan-03	12.36	538.00	0.42	1.13	138.00	12.68	8,626
1-Jan-04	13.00	575.00	0.48	1.09	181.00	13.41	9,123
1-Jan-05	13.82	557.00	0.52	1.11	227.00	14.33	9,749
1-Jan-06	14.84	552.00	0.57	1.12	279.00	15.57	10,590
1-Jan-07	16.30	547.00	0.64	1.14	380.00	17.33	11,789
1-Jan-08	18.37	547.00	0.73	1.08	618.00	19.38	13,183
1-Jan-09	20.40	568.00	0.79	1.03	692.00	21.47	14,601
1-Jan-10	22.54	583.00	0.81	1.08	749.00	23.71	16,126
1-Jan-11	24.88	600.00	0.88	1.05	887.00	26.37	17,940
1-Jan-12	27.87	614.00	0.93	1.05	1,118.00	29.46	20,039
1-Jan-13	31.05	647.00	0.97	1.03	1,254.00	32.76	22,287
1-Jan-14	34.48	683.00	1.00	1.00	1,333.00	34.52	23,481
1-Jan-15	-	720.00	1.00	1.05	1,541.00	35.36	24,052
1-Jan-16	-	787.00	1.06	1.07	1,690.00	38.14	25,942

Appendix B.3 Estimates of Total Capital Stocks in Tanzania 1999-2016							
Fiscal Year	**Capital Stock (Constant,2011 US$ Billion)**	**Official Exch. Mid-Rate (TZS /US$)**	**GDP Deflator Index (2007=100)**	**1 + Δ GDP deflator**	**GFCF (Billions of TZS)**	**Mid-Year Amount of Stocks (Constant,2011 US$ Billion)**	**Mid-Year Amount of Stocks (Billions of TZS - 2014)**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1-Jan-99	212.15	745	0.46	1.08	1.23	212.36	110,810
1-Jan-00	212.56	800	0.49	1.05	1.33	213.71	111,514
1-Jan-01	214.85	876	0.52	1.07	1.55	216.67	113,061
1-Jan-02	218.49	967	0.55	1.08	1.75	221.85	115,765
1-Jan-03	225.21	1,038	0.60	1.07	2.28	230.33	120,187
1-Jan-04	235.44	1,089	0.64	1.26	3.10	242.53	126,555
1-Jan-05	249.62	1,129	0.81	1.16	4.81	257.90	134,577
1-Jan-06	266.19	1,252	0.94	1.06	6.46	276.27	144,164
1-Jan-07	286.36	1,245	1.00	1.16	8.43	299.29	156,175
1-Jan-08	312.23	1,196	1.16	1.09	11.03	324.69	169,429
1-Jan-09	337.16	1,320	1.27	1.09	10.88	349.71	182,484
1-Jan-10	362.26	1,396	1.38	1.12	12.57	380.48	198,540
1-Jan-11	398.70	1,557	1.54	1.11	17.32	416.80	217,493
1-Jan-12	434.91	1,572	1.71	1.08	18.79	453.96	236,880
1-Jan-13	473.00	1,598	1.84	1.05	21.63	492.81	257,157
1-Jan-14	512.62	1,653	1.93	1.07	25.97	513.26	267,828
1-Jan-15	-	1,991	2.06	1.06	31.12	543.67	283,693
1-Jan-16	-	2,177	2.19	1.05	34.77	572.79	298,891

Appendix B.4 Estimates of Total Capital Stocks in Uganda 1999-2016							
Fiscal Year	**Capital Stock (Constant,2011 US$ Billion)**	**Official Exch. Mid-Rate (UGX /US$)**	**GDP Deflator Index (2010=100)**	**1 + Δ GDP deflator**	**GFCF (Billions of UGX)**	**Mid-Year Amount of Stocks (Constant,2011 US$ Billion)**	**Mid-Year Amount of Stocks (Billions of UGX - 2014)**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1-Jan-99	51.89	1,454.83	0.49	1.11	1.57	53.76	94,763
1-Jan-00	55.62	1,644.48	0.54	1.05	1.80	57.59	101,527
1-Jan-01	59.57	1,755.66	0.57	0.97	1.96	61.79	108,929
1-Jan-02	64.01	1,797.55	0.55	1.08	2.16	66.54	117,302
1-Jan-03	69.07	1,963.72	0.59	1.16	2.57	72.05	127,009
1-Jan-04	75.03	1,810.30	0.69	0.98	3.06	78.77	138,867
1-Jan-05	82.52	1,780.67	0.68	1.02	3.56	86.69	152,813
1-Jan-06	90.85	1,831.45	0.69	1.07	3.81	95.73	168,762
1-Jan-07	100.62	1,723.49	0.74	1.06	4.63	107.37	189,279
1-Jan-08	114.13	1,720.44	0.79	1.15	5.57	121.55	214,268
1-Jan-09	128.97	2,030.49	0.90	1.11	8.64	136.44	240,517
1-Jan-10	143.91	2,177.56	1.00	1.05	10.33	152.51	268,848
1-Jan-11	161.11	2,522.75	1.05	1.22	12.72	169.72	299,191
1-Jan-12	178.33	2,504.56	1.27	1.04	15.93	186.93	329,523
1-Jan-13	195.52	2,586.89	1.32	1.03	15.93	203.97	359,565
1-Jan-14	212.41	2,599.79	1.37	1.05	17.81	209.76	369,785
1-Jan-15	-	3,240.65	1.44	1.04	18.59	219.48	386,905
1-Jan-16	-	3,420.10	1.49	1.06	18.50	225.09	396,800

The following sources and notes have been used in Appendix B (1,2,3 & 4);

Sources & Notes:
Depreciation rate (Private Capital): 4.25%, Depreciation rate (Public Capital): 2.50%.
Depreciation rate (Economy) is approximately the average depreciation rate of private and public capital and equals 3.375%.
Depreciation rate on investment = (3.375%/2)
Column (2) is obtained from University of California, Davies, Penn World Table 9.0
Column (3), (4) and (6) are obtained from World Bank, national accounts data.
Column (7): from 1999 to 2013 is the mid-point values between two successive years in column (2). 2014,2015 & 2016 are estimated as follows:
Kt+1 = Kt*(1- 3.43%) *(1 + Δ GDP deflator) + GFCF * (1 – 1.25%)/(Exchange rate /1000)
Column (8): is the converted values of (7) in 2014 prices and local currency.

Appendix B.5: Estimates of Total Capital Stocks in Ghana (2005-2017)								
Fiscal Year	**Capital Stock (Constant ,2011 US$ Billion)**	**Official Exch. Mid-Rate (GHS/US$)**	**GDP Deflator Index (2013=100)**	**1 + ΔGDP deflator**	**GFCF (Billions of GHS)**	**Mid-Year Amount of Stocks (Constant,2011 US$ Billion)**	**Official Exch. Mid-Rate (GHS/US$)**	**Mid-Year Amount of Stocks (Billions of GHS-2013)**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
January 1, 2005	152.14	0.91	0.30	1.13	5.12	156.11	0.91	314.92
January 1, 2006	160.08	0.92	0.34	1.19	5.48	165.07	0.92	333.01
January 1, 2007	170.06	0.94	0.41	1.19	4.54	177.83	0.94	358.74
January 1, 2008	185.59	1.06	0.49	1.16	6.31	190.11	1.06	383.52
January 1, 2009	194.63	1.41	0.56	1.17	7.27	203.13	1.41	409.79
January 1, 2010	211.63	1.43	0.66	1.14	6.94	224.04	1.43	451.97
January 1, 2011	236.45	1.51	0.75	1.15	9.20	252.46	1.51	509.30
January 1, 2012	268.48	1.80	0.86	1.16	15.59	281.96	1.80	568.82
January 1, 2013	295.45	1.95	1.00	1.22	31.85	303.90	1.95	613.07
January 1, 2014	312.35	2.90	1.22	1.14	44.62	370.21	2.90	746.85
January 1, 2015	-	3.67	1.39	1.15	52.76	416.34	3.67	839.90
January 1, 2016	-	3.91	1.60	1.10	58.02	471.95	3.91	952.09
January 1, 2017	-	4.35	1.76	-	52.82	511.51	4.35	1,031.90

Sources & Notes:
Average Depreciation Rate (2014-2017) for Ghana is Obtained from Penn World Table 9.0 and equals 4.57%
Depreciation rate on investment = (4.57%/2)
Column (2) is obtained from University of California, Davies, Penn World Table 9.0
Column (3) is obtained from IMF, International Financial Statistics.
Column (4) is obtained from IMF, World Economic Outlook.
Column (6) is obtained from Ghana Statistical Services (GSS).
Column (7): from 2005 to 2013 is the mid-point values between two successive years in column (2). 2014, 2015 & 2016 are estimated as follows:

$$Kt+1 = Kt*(1- 4.57\%) *(1 + \Delta \text{ GDP deflator}) + GFCF * (1 – 2.29\%)/ (\text{Exchange rate})$$

Column (8): is the converted values of (7) in 2013 prices and local currency.

Appendix C: Return to Domestic Savings

C.1: Return to Domestic Savings in Kenya (1999-2016)										
	Current Prices (Billion KES)						Constant Prices (2014 Billion KES)			
Year	Gross-of-tax Return to Capital	Taxes on income, profits and capital gains of corporates	Taxes on income, profits and capital gains of individuals	Financial Intermediation Charges	Taxes on property	Return to Domestic Savings	GDP Deflator Index (2009=100)	Real Return to Domestic Savings	Remunerative capital stock	Rate of Return to Domestic Savings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1999	271	18	9	5	-	240	0.45	752	5,959	12.62%
2000	283	17	9	5	-	252	0.48	745	6,167	12.08%
2001	309	18	9	7	-	276	0.48	804	6,353	12.65%
2002	314	18	9	5	-	282	0.49	812	6,509	12.48%
2003	340	23	11	6	-	300	0.52	814	6,671	12.21%
2004	379	26	11	5	-	337	0.56	854	6,906	12.36%
2005	440	32	14	6	0.18	387	0.58	936	7,226	12.95%
2006	628	39	14	17	0.07	558	0.72	1,091	7,600	14.35%
2007	749	43	16	20	0.86	669	0.78	1,209	7,989	15.13%
2008	872	72	21	26	1.32	751	0.90	1,179	8,370	14.08%
2009	1,010	63	26	33	1.15	886	1.00	1,246	8,811	14.15%
2010	1,122	68	29	41	1.13	983	1.02	1,353	9,315	14.53%
2011	1,310	86	40	52	1.05	1,131	1.13	1,406	9,877	14.24%
2012	1,487	95	56	63	1.21	1,272	1.24	1,448	10,480	13.81%
2013	1,643	111	69	70	1.08	1,393	1.30	1,505	11,119	13.54%
2014	1,768	136	60	79	1.13	1,491	1.41	1,491	12,048	12.37%
2015	2,043	127	97	92	1.05	1,726	1.55	1,569	13,352	11.75%
2016	2,357	152	88	106	1.24	2,010	1.67	1,689	14,485	11.66%
									Average	**13.16%**

Sources & Notes:
Column (1) is obtained from column (9) in Appendix A.1.
Column (2), (3) and (5) are obtained from OECD.Stat.
Column (4) = 50% of total imputed bank service (intermediation) charges. Financial intermediation charges is obtained from EAC Data portal.
Column (6) = (1) -(2) -(3) -(4) -(5)
Column (7) is obtained from World Bank, national accounts data.
Column (8) is the adjusted values of column (6) for GDP- deflator at basic year.
Column (9) is obtained from column (13) in Appendix A.1.
Column (10) = (8)/ (9)

C.2: Return to Domestic Savings in Rwanda (1999-2016)

	Current Prices (Billion RWF)						Constant Prices (2014 Billion RWF)			
Year	Gross-of-tax Return to Capital	Taxes on income, profits and capital gains of corporates	Taxes on income, profits and capital gains of individuals	Financial Intermediation Charges	Taxes on property	Return to Domestic Savings	GDP Deflator Index (2014=100)	Real Return to Domestic Savings	Remunerative capital stock	Rate of Return to Domestic Savings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1999	249.26	8.45	0.29	5.23	0.14	235.14	0.35	672.46	4,766.79	14.11%
2000	278.92	4.23	0.33	5.80	0.13	268.43	0.36	746.87	4,972.28	15.02%
2001	298.79	9.39	0.39	6.26	0.15	282.59	0.36	777.36	5,184.93	14.99%
2002	324.45	10.31	0.51	5.59	0.22	307.83	0.35	891.70	5,422.73	16.44%
2003	387.96	9.71	0.78	6.85	0.01	370.61	0.42	881.48	5,693.16	15.48%
2004	474.19	7.75	1.03	8.56	0.04	456.80	0.48	960.63	6,020.93	15.95%
2005	566.38	13.67	1.23	9.66	0.04	541.77	0.52	1,043.95	6,434.10	16.23%
2006	748.73	16.97	1.75	11.80	0.03	718.18	0.57	1,251.48	6,989.71	17.90%
2007	894.87	20.88	2.40	15.65	0.03	855.92	0.64	1,334.60	7,780.47	17.15%
2008	1,147.25	36.76	3.17	20.00	0.02	1,087.29	0.73	1,483.43	8,700.65	17.05%
2009	1,308.15	39.14	4.08	20.49	0.08	1,244.36	0.79	1,568.34	9,636.92	16.27%
2010	1,452.69	42.05	5.10	24.81	0.10	1,380.63	0.81	1,695.89	10,642.85	15.93%
2011	1,692.33	51.78	6.21	34.74	0.07	1,599.54	0.88	1,813.36	11,840.44	15.31%
2012	1,893.08	70.17	7.89	42.97	0.03	1,772.02	0.93	1,908.51	13,225.86	14.43%
2013	2,033.60	96.49	9.15	49.29	0.02	1,878.65	0.97	1,935.96	14,709.18	13.16%
2014	2,217.27	93.69	9.66	57.39	0.02	2,056.51	1.00	2,056.51	15,497.59	13.27%
2015	2,407.96	112.85	11.23	68.63	0.63	2,214.62	1.00	2,208.31	15,874.41	13.91%
2016	2,627.57	136.35	12.69	73.39	0.78	2,404.35	1.06	2,272.61	17,121.61	13.27%
									Average	**15.33%**

Sources & Notes:
Column (1) is obtained from column (9) in Appendix A.2.
Column (2), (3) and (5) are obtained from OECD.Stat.
Column (4) = 50% of total imputed bank service (intermediation) charges. Financial intermediation charges is obtained from EAC Data portal.
Column (6) = (1) -(2) -(3) -(4) -(5)
Column (7) is obtained from World Bank, national accounts data.
Column (8) is the adjusted values of column (6) for GDP- deflator at basic year.
Column (9) is obtained from column (13) in Appendix A.2.
Column (10) = (8)/ (9)

C.3: Return to Domestic Savings in Tanzania (1999-2016)

	Current Prices (Billion TZS)					Constant Prices (2014 Billion TZS)			
Year	**Gross-of-tax Return to Capital**	**Taxes on income, profits and capital gains of corporates**	**Taxes on income, profits and capital gains of individuals**	**Financial Intermediation Charges**	**Return to Domestic Savings**	**GDP Deflator Index (2007=100)**	**Real Return to Domestic Savings**	**Remunerative capital stock**	**Rate of Return to Domestic Savings**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
1999	2,690	65	36	40	2,549	0.46	10,830	81,999	13.21%
2000	3,015	55	79	45	2,836	0.49	11,199	82,521	13.57%
2001	3,322	47	72	43	3,161	0.52	11,853	83,665	14.17%
2002	3,852	57	77	48	3,669	0.55	12,847	85,666	15.00%
2003	4,529	78	88	57	4,306	0.60	13,902	88,939	15.63%
2004	5,182	109	106	65	4,902	0.64	14,789	93,650	15.79%
2005	7,165	153	114	93	6,806	0.81	16,235	99,587	16.30%
2006	8,826	203	134	121	8,367	0.94	17,137	106,681	16.06%
2007	10,274	267	166	178	9,664	1.00	18,685	115,570	16.17%
2008	12,687	375	205	155	11,952	1.16	19,931	125,377	15.90%
2009	14,625	415	257	175	13,779	1.27	21,030	135,038	15.57%
2010	17,213	418	318	209	16,269	1.38	22,729	146,919	15.47%
2011	21,320	538	351	308	20,123	1.54	25,204	160,945	15.66%
2012	24,886	780	537	348	23,221	1.71	26,263	175,292	14.98%
2013	29,271	1,040	687	459	27,086	1.84	28,450	190,296	14.95%
2014	33,955	1,484	824	515	31,132	1.93	31,132	198,193	15.71%
2015	37,944	1,183	968	587	35,206	2.06	33,041	209,933	15.74%
2016	42,439	1,380	1,184	667	39,208	2.19	34,663	221,179	15.67%
								Average	**15.31%**

Sources & Notes:
Column (1) is obtained from column (10) in Appendix A.3.
Column (2) and (3) are obtained from Tanzania Revenue Authority (TRA)
Column (4) = 50% of total imputed bank service (intermediation) charges. Financial intermediation charges are obtained from EAC Data portal.
Column (5) = (1) -(2) -(3) -(4)
Column (6) is obtained from World Bank, national accounts data.
Column (7) is the adjusted values of column (5) for GDP- deflator at basic year.
Column (8) is obtained from column (14) in Appendix A.3.
Column (9) = (7)/ (8)

C.4: Return to Domestic Savings in Uganda (1999-2016)

	Current Prices (Billion UGX)					Constant Prices (2014 Billion UGX)			
Year	Gross-of-tax Return to Capital	Taxes on income, profits and capital gains of corporates	Taxes on income, profits and capital gains of individuals	Financial Intermediation Charges	Return to Domestic Savings	GDP Deflator Index (2010=100)	Real Return to Domestic Savings	Remunerative capital stock	Rate of Return to Domestic Savings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1999	3,669	43	38	56	3,533	0.49	9,854	64,439	15.29%
2000	3,963	40	35	64	3,825	0.54	9,600	69,039	13.90%
2001	4,737	53	44	81	4,559	0.57	10,946	74,072	14.78%
2002	4,931	70	52	74	4,735	0.55	11,742	79,765	14.72%
2003	5,936	81	70	114	5,670	0.59	13,043	86,366	15.10%
2004	6,429	124	77	126	6,100	0.69	12,140	94,430	12.86%
2005	7,821	160	22	137	7,502	0.68	15,194	103,913	14.62%
2006	8,942	182	21	165	8,573	0.69	16,955	114,758	14.77%
2007	10,448	216	28	204	10,001	0.74	18,429	128,710	14.32%
2008	12,684	256	36	256	12,136	0.79	21,025	145,702	14.43%
2009	16,478	281	49	327	15,821	0.90	23,925	163,552	14.63%
2010	18,361	372	53	382	17,554	1.00	24,009	182,817	13.13%
2011	24,360	478	24	423	23,436	1.05	30,635	203,450	15.06%
2012	27,312	656	2	562	26,091	1.27	28,065	224,075	12.52%
2013	29,650	820	28	606	28,197	1.32	29,157	244,504	11.92%
2014	32,448	756	132	658	30,902	1.37	30,902	251,454	12.29%
2015	37,213	1,005	199	727	35,282	1.44	33,600	263,096	12.77%
2016	38,809	1,087	255	790	36,677	1.49	33,739	269,824	12.50%
								Average	**13.87%**

Sources & Notes:
Column (1) is obtained from column (9) in Appendix A.4.
Column (2) and (3) are obtained from OECD.Stat.
Column (4) = 50% of total imputed bank service (intermediation) charges. Financial intermediation charges is obtained from EAC Data portal.
Column (5) = (1) -(2) -(3) -(4)
Column (6) is obtained from World Bank, national accounts data.
Column (7) is the adjusted values of column (5) for GDP- deflator at basic year.
Column (8) is obtained from column (13) in Appendix A.4.
Column (9) = (7)/ (8)

C.5: Return to Domestic Savings in Ghana (2006-2017)

	Current Prices (billions GHS)						Constant Prices (2013 billion GHS)			
Fiscal Year	Gross-of-tax Return to Capital	Taxes on Income and Profits Paid by Corporations	Taxes on Income and Profits Paid by Households	Financial Intermediation Charges	Taxes on Buildings	Return to Domestic Savings	GDP Deflator Index (2013=100)	Real Return to Domestic Savings	Remunerative capital stock	Rate of Return to Domestic Savings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2006	11.69	0.32	0.02	0.20	0.01	11.14	0.38	29.22	199.81	14.62%
2007	14.19	0.42	0.03	0.25	0.01	13.47	0.44	30.54	215.24	14.19%
2008	18.08	0.55	0.04	0.34	0.01	17.13	0.52	33.14	230.11	14.40%
2009	21.99	0.74	0.05	0.60	0.01	20.59	0.59	34.87	245.87	14.18%
2010	27.85	1.00	0.07	0.76	0.02	26.01	0.69	37.81	271.18	13.94%
2011	36.01	1.70	0.09	0.73	0.02	33.47	0.77	43.39	305.58	14.20%
2012	44.75	2.42	0.11	1.16	0.03	41.04	0.89	46.33	341.29	13.57%
2013	53.70	2.65	0.13	1.46	0.02	49.43	1.00	49.43	367.84	13.44%
2014	65.33	3.31	0.15	2.18	0.04	59.66	1.22	48.84	448.11	10.90%
2015	73.07	4.06	0.18	2.73	0.05	66.05	1.39	47.60	503.94	9.45%
2016	84.25	5.08	0.21	3.36	0.06	75.55	1.60	47.24	571.26	8.27%
2017	96.16	6.33	0.23	4.07	0.07	85.46	1.76	48.43	619.14	7.82%
									Average	**12.42%**

Sources & Notes:
Column (1) is obtained from Column (11) of Appendix A.
Column (2) is obtained from Ghana Revenue Authority (GRA).
Column (3) is the share of (self-employed Income/Profit tax) added to the value added of capital. Sources of self-employed tax: Ghana Revenue Authority.
Column (4) = 50% of total imputed bank service (intermediation) charges. Financial intermediation charges are obtained from GSS.
Column (5) is obtained from Ministry of Local Government & Rural Development.
Column (6) = (1) -(2) -(3) -(4) -(5)
Column (7) is obtained from IMF, World Economic Outlook.
Column (8) is the adjusted values of column (6) for GDP- deflator at base year 2013.
Column (9) is obtained from Column (15) of Appendix A
Column (10) = (8)/ (9)