National Parameters, Economic Opportunity Cost of Labor, Social Value of Time, and Commodity-Specific Conversion Factors for Public Project Appraisal in Kenya

Summary Report

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LIST OF ABBREVIATIONS

CF	Conversion Factor
COMESA	Common Market for Eastern and Southern Africa
CRI	Cambridge Resources International Inc.
DSCR	Debt Service Coverage Ratio
EAC	East African Community
ENPV	Economic Net Present Value
EOCK	Economic Opportunity Cost of Capital
EOCL	Economic Opportunity Cost of Labour
EPRA	Energy and Petroleum Regulatory Authority
ERR	Economic Rate of Return
FDI	Foreign Direct Investment
FEP	Foreign Exchange Premium
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
FOB	Free on Board
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GVA	Gross Value Added
HS	Harmonized System (Harmonized Commodity and Coding System)
ICSD	Investment and Capital Dataset
IGAD	Intergovernmental Authority on Development

IIA	Integrated Investment Appraisal
IIR	Internal Rate of Return
ILO	International Labor Organization
IMF	International Monetary Fund
KES	Kenyan Shilling
KM	Kilometer
LB	Labour Benefits
LE	Labour Externality
MDAs	Ministries, Departments and Agencies
MIS	Malaria Indicator Survey
NPV	Net Present Value
NTP	Non-Tradable Outlays
NTSA	National Transport and Safety Authority
PV	Present Value
ROE	Return on Equity
RWG	Real Growth Rate
SOEs	State Owned Enterprises
SVT	Social Value of Time
UNICEF	United Nations Children's Emergency Fund
USD	United States Dollars
VAT	Value Added Tax
VIP	Ventilated Improved Pit
WCO	World Customs Organization

TERMS AND DEFINITIONS

Business Cycle: Business cycles are intervals of expansion followed by a recession in economic activity. They have implications for the welfare of the broad population as well as for private institutions.

Commodity Specific Conversion Factor: The ratio of the economic value of a commodity to its financial value.

Economic Opportunity Cost: The value of utility that can be derived were the same resources used in the next best alternative to the proposed project or programme.

Economic Resource Flow Statement: A statement used to organize and present the economic inflow and outflow of a project.

Financial Cash Flow Statement: A statement used to organize and present the project's financial cash flow structure. It is generally divided into two sections, the cash inflow, and the cash outflow.

Financial Intermediation: This is the process of transferring sums of money from economic agents with surplus funds to economic agents that would like to utilize those funds.

Foreign Exchange Premium (FEP): The proportion with which the economic exchange rate exceeds the market exchange rate.

Gross Fixed Capital Formation: Gross fixed capital formation is a macroeconomic concept used in official national accounts such as the United Nations System of National Accounts, National Income and Product Accounts, and the European System of Accounts. Statistically, it measures the value of new or existing fixed assets acquisitions by the business sector, governments, and "pure" households (excluding their unincorporated enterprises) fewer disposals of fixed assets. GFCF is a component of the expenditure on GDP and thus shows something about how much of the new value-added in the economy is invested rather than consumed.

Harmonized System (HS): The Harmonized Commodity Description and Coding System, generally known as the Harmonized System (HS), is used by the World Customs Organization (WCO) as an internationally standardized system of names and numbers to classify traded products.

Infrastructure Investment Project: Spending on new assets; replacements; maintenance and repairs; upgrades and additions; and rehabilitation, renovation, and refurbishment of assets.

Integrated Investment Appraisal (IIA): A methodology of conducting investment appraisal that incorporates the financial, economic, stakeholder, and risk analyses of the project together.

National Parameters Database: A compilation of the national parameters and the commodity-specific conversion factors developed for Kenya.

Net Economic Benefit: The difference between the economic benefit and the resource cost (economic cost)

Newly Stimulated Household Savings: The new household savings stimulated by the increase in the demand for funds needed to finance the investment project.

Premium for Non-Tradable Outlays: The percentage difference between the financial and economic cost of outlays on non-tradables.

Non-Traded Goods (Non-Tradables): These are goods and services whose prices are not determined in the world market. Their prices are instead determined in the domestic markets.

Opportunity Cost of Funds: This is the expected return from the next best alternative foregone.

Project: A unique set of processes consisting of coordinated and controlled activities with start and end dates performed to achieve the project objective.

Real Value: The actual value of goods and services. It does not include the impact of inflation. Real values of goods and services are obtained from nominal values by adjusting for inflation.

Reproducible Remunerative Investment: Represents the remunerative portion of the total investment in six assets, i.e., structures, transport equipment, computers, communication equipment, software, and other machinery and assets.

Shadow Price: Is a monetary value assigned to currently unknowable or difficult-to-calculate costs in the absence of correct market prices. It is based on the willingness to pay principle – the most accurate measure of the value of a good or service is what people are willing to give up getting it.

Traded Goods (Tradables): Goods whose prices are determined in the world market.

1. Introduction

Following the completion of the Guidelines on Public Investment Management for National Government and its Entities, the Government of Kenya proceeded to estimating the National Parameters, Economic Opportunity Cost of Labour (EOCL), Social Value of Time and the Commodity-Specific Conversion Factors (CSCFs). These estimates are then put together in the National Parameters Database. The core objective of the exercise is to facilitate the economic and social appraisal of public investment projects by increasing the ease and accuracy with which economic analyses are carried out, during the appraisal process.

The scope of the assignment includes:

1. Estimation of national parameters, including:
    a. Economic Opportunity Cost of Capital (EOCK).
    b. Foreign Exchange Premium (FEP).
    c. Premium on non-tradable outlays (NTP).
2. Estimation CSCFs for tradable commodities.
3. Estimation of CSCFs for non-tradable services.
4. Estimation of the EOCL.
5. Estimation of Social Value of Time.
6. Development of a user-friendly web-based software system that enables stakeholders[1] to search and calculate conversion factors for tradable and non-tradable goods.

The national parameters, EOCL, SVT and CSCFs, are temporarily available under open access at http://kenya.cri-world.com. The software provides all the details of the estimates made, allowing the analyst to apply any changes if deemed necessary. However, to further strengthen the consistency of the projects appraisal element of the Public Investment Management System in Kenya, it is recommended to enforce the use of the software to prepare and appraise public investment projects across all government sectors, including public-private partnerships.

This report starts with the discussion of the relevance of national parameters to the public investment management (PIM) system in Kenya, then presents the application of the CSCFs and national parameters before it concludes with recommendations on how to ensure that the National parameters database achieves the desired objectives. Details of the methodology employed in estimating the national parameters, commodity-specific conversion factors, the economic opportunity cost of labor, and a framework for the valuation of the social value of time in Kenya are presented in Annexures A, B, C, and D, respectively.

[1] Main stakeholders are but not limited to Ministries, Departments and Agencies (MDAs), Metropolitan, Municipal and District Assemblies (MMDAs), State Owned Enterprises (SOEs), academia, development agencies, and policy makers.

2. The Role of CSCFs in the Public Investment Management System.

To enable public institutions to meet the requirements of the Public Investment Management framework, the Guidelines on Public Investment Management for National Government & its Entities, which provides the methodologies, criteria, and standards for appraisal of project concept notes, pre-feasibility and feasibility studies, and the general management of public investments, was developed and is complimented by the estimation of CSCFs and National Parameters.

In identifying the economic viability of the projects as mentioned in guideline 24 (4), the economic analysis must be conducted. To do this, The Guidelines employs the Integrated Investment Appraisal (IIA) approach for project appraisal. The approach begins with the financial analysis of the projects from different perspectives[2] (as required based on the nature of the project and the funding modality), which serves as the foundation for the economic analysis, stakeholder analysis, and the risk analysis. To make the transition from the financial analysis – which uses the market value of the inputs and outputs of the project, to economic analysis – which uses the economic values of project inputs and outputs, the relevant Commodity Specific Conversion Factors (CSCFs) are employed. Therefore, the CSCFs are relevant to Project Sponsors when the objective is to assess the economic viability of a project. The resulting net resource flow statement is then discounted using the economic opportunity cost of capital (EOCK) to obtain the economic decision-making metrics, such as the Economic Net Present Value (ENPV).

Estimating the conversion factors for different goods and services used and produced by a project can be tedious and error-prone. If not correctly done, estimating them every time they are needed can affect the accuracy of the appraisal process and lead to incorrect decisions on whether or not the project can proceed to the design development stage. Therefore, to improve the accuracy of public project appraisal and to make it easy for Project Sponsors to correctly move from financial to economic analysis, as described in the Fourth Schedule of the Guidelines, the CSCFs for tradable and non-tradable goods and services as well as the required National Parameters have been estimated and are contained in the National Parameters Database.

As described earlier, the financial costs of project inputs and outputs do not always reflect their true costs or benefits to the society. However, these financial values can be converted to their corresponding economic values by applying the appropriate CSCF.

3. Moving from Financial Analysis to Economic Analysis

The IIA approach begins with the financial analysis of projects. In this analysis, the analyst compares the financial revenues generated by the project (where applicable) with the financial costs of the project. The financial cash flow statement generated in the financial analysis is then used to estimate the project's financial outputs, which includes the Financial Net Present Value

[2] The different perspectives include the lenders, equity, fiscus etc.

(FNPV), the Financial Internal Rate of Return (FIRR), Debt Service Coverage Ratios (DSCR), etc. It is also used to assess the affordability and budgetary impacts of the project. In addition, in the IIA approach, the financial analysis serves as the foundation for the economic analysis.

Unlike the financial analysis that focuses on a project's financial outlook, the economic analysis focuses on the project's impact on the economy as a whole. Project inputs and outputs are valued using their true economic values. This leads to the generation of the resource flow statement, which can be used to estimate the project's economic outputs, including the Economic NPV, Economic Rate of Return, etc. The economic and financial analyses are then used to assess the impacts of the project on the stakeholders. Figure 1 below shows the big picture of the IIA approach.

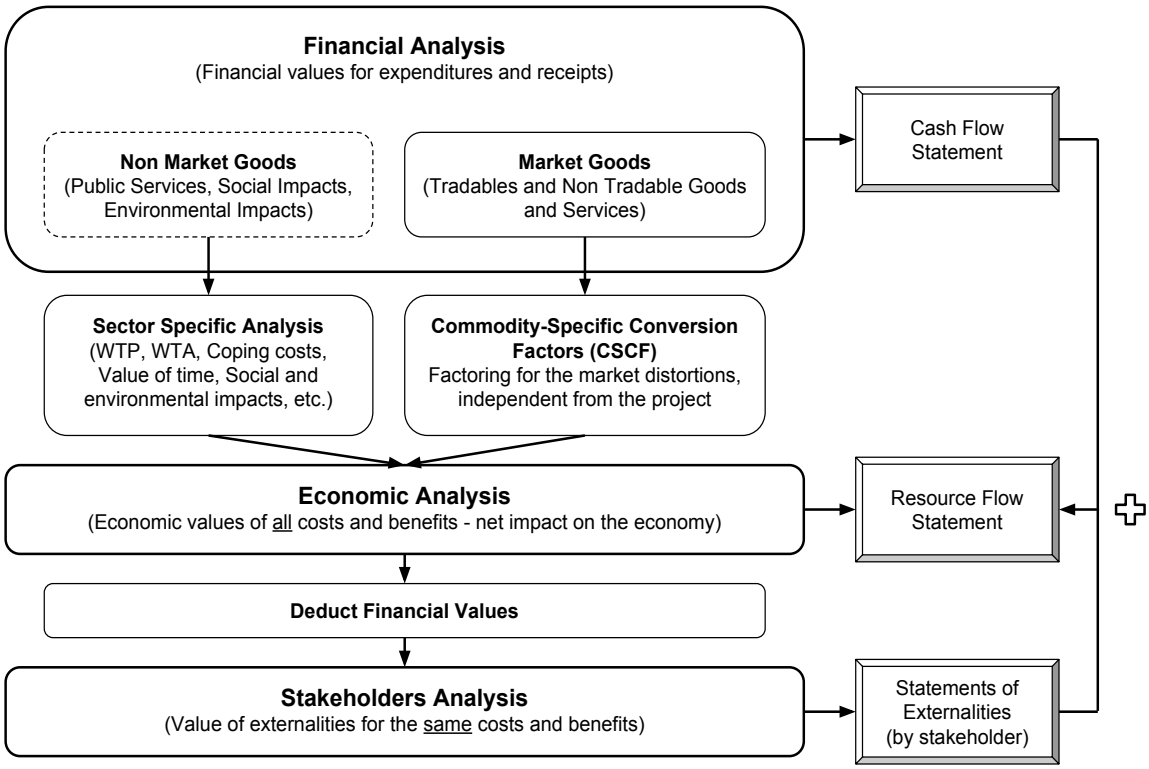

Figure 1: The Big Picture of the Integrated Investment Appraisal Approach

To move from financial analysis to economic analysis, the values of the project inputs and outputs must be adjusted to reflect their true economic values. To make this transition, the following conversions are necessary:

i. Estimation of the economic value of project outputs/services. For internationally tradable outputs, for example, steel, the CSCF should be used. However, it must be pointed out that the National parameters database does not provide the conversion factors for non-tradable outputs, for example, road rehabilitation projects. The economic values of these outputs should be estimated using sector-specific guidelines.

ii. Estimation of the economic resource costs of project inputs. This involves the application of the CSCFs to convert the market values of the project inputs to their economic values. The inputs are generally divided into three categories:

   a. Tradable project inputs;
   b. Non-tradable project inputs; and
   c. Labour

iii. Substitution of the discount rate used in the financial analysis (sometimes the ROE) with the economic opportunity cost of capital (EOCK)

Illustration

Box 1: Project Introduction
As part of its mandate to contribute to the National Development Plan of eliminating poverty and reducing inequality by 2030, the Ministry of Agriculture has identified that investing specifically in the cultivation of maize will play a significant role in achieving this objective.

The financial cash flow of the project is presented below. The values of the project inputs and outputs used in developing the cash flow statement are based on their market values.

Table 1: Illustrative Cash Flow Statement (Million Kenyan Shilling)

Project Year / Cash Flow Item	***2021***	***2022***	***2023***	***2024…***	***…2030***	***2031***	***2032***
Cash Inflow							
Incremental Revenue from Sale of Maize	-	315	631	946	1,262	1,262	1,262
Incremental Change in AR	-	-	-	-	-	-	-
Donors Grant to Project	578	578	578	578	-	-	-
Maintenance Grant - Government	-	14	21	28	28	28	-
Residual Value of Irrigation System	-	-	-	-	-	-	501
Total Cash Inflow	**578**	**907**	**1,230**	**1,552**	**1,290**	**1,290**	**1,763**
Cash Outflow							
Construction of Irrigation Facilities	578	578	578	578	-	-	-
Cost of Irrigation Facilities Maintenance	-	14	21	28	28	28	-
Incremental Cost of Certified Seeds	6	12	18	24	24	24	-
Incremental Cost of DAP Fertilizer	(11)	(21)	(32)	(43)	(43)	(43)	-
Incremental Cost of Urea Fertilizer	5	10	15	20	20	20	-
Incremental Cost of NPK Fertilizer	45	89	134	179	179	179	-
Incremental Cost of Storage bags	-	79	157	236	315	315	315
Skilled Labour	30	100	120	200	320	320	50
Unskilled Labour	37	68	150	172	87	87	89
Incremental Change in AP	-	-	-	-	-	-	-
Incremental Change in CB	241	258	275	292	67	67	(898)
Total Cash Outflow	**931**	**1,187**	**1,436**	**1,686**	**997**	**997**	**(444)**
NET CASH FLOW	**(353)**	**(280)**	**(207)**	**(133)**	**293**	**293**	**2,206**

Assuming the ROE is 15 percent, the FNPV @ 15% = 436 million Shilling, and the Financial IRR = 22%.

To convert the items in the cash flow statement to their corresponding economic values (resource cost and benefits), the CSCF of each item is obtained using the National parameters database, following the steps discussed above.

i. Estimate the economic value of the output: The output of this project is maize (corn). Since maize is one of the agricultural produces that Kenya exports, the project produces an exportable output. On the National parameters database, we select the "Tradables" tab, and we can either search by "Commodities" or by "Categories." If we choose "Commodities," we can then type the project output into the search bar. This might bring up several related commodities, out of which the most applicable is selected. In this case, we choose "Maize (corn) flour," and we specify that it is an exportable output. This gives a conversion factor of 1.0500. To obtain the economic value of the project output (maize), we multiply the market value by the conversion factor. It is worth noting that when the CSCF of a commodity is greater than 1, it means that the economic value of the commodity is greater than its market value.

ii. Estimate the resource costs of inputs: This involves the application of the CSCFs to convert all the cost items of the project to their corresponding economic value. This is achieved by multiplying the market values by the corresponding CSCF.

    a. **Tradable project inputs**: An example of an input that falls under this category (in the illustrative example) is the DAP fertilizer, an importable input. Following similar steps to those described in i above, the National parameters database is used to obtain the CSCF of 0.9953. The market value of DAP is then multiplied by 0.9953 to get the economic cost of DAP fertilizer. If the CSCF of an input is less than 1, it means that the economic cost of the commodity is less than its financial cost.

    b. **Non-tradable project inputs**: An example of such input is the construction of irrigation facilities. To obtain the CSCF for this project input, the "Non-tradables" tab is selected, and "construction" is picked as the commodity of interest. Doing this gives a CSCF of 0. 0.8140. Again, the economic value is obtained by estimating the product of the market value of construction and a CSCF of 0. 0.8140.

    c. **Labour**: The concept of EOCL is premised on the fact that employing a person (a resource) for one project implies that the individual is giving up other opportunities that would utilize their time. In other words, people are being drawn away from their other productive activities. However, when a project pays a wage higher than a person's alternative wage elsewhere, it creates a positive externality (benefit to the employee). Similarly, in this situation, the project will also generate a positive fiscal externality. The higher wage rate will put the worker in a higher tax bracket, thus increasing the tax paid/generated by the employee. All of these are accounted for in the estimation of the conversion factors for all categories of Labor in Kenya.

The National Parameters Database takes account of the different categories of workers in Kenya. Similar to the non-tradables, the CSCF for labour is obtained by selecting the "Labour" tab and picking the category of interest. The CSCF for skilled labour is 0.80.

iii. Substitution of the discount rate with the EOCK. The EOCK is a national parameter and is not project-specific, and it represents the opportunity cost of investing resources into the project from the perspective of the economy. Instead of the ROE or the discount rate used in the financial analysis, the EOCK is used to discount the project's net resource flow. To obtain the EOCK using the National parameters database, the "National Parameters" tab, which contains all the estimated national parameters, is selected. The EOCK for Kenya was estimated to be 11.5%.

The economic resource flow statement of the illustrative project is presented below. To obtain the economic values of the project inputs and outputs presented in the resource flow statement, each of the items in the cash flow statement is multiplied by their corresponding CSCFs.

Table 2: Resource Flow Statement (Million Kenyan Shilling)

	CF	***2021***	***2022***	***2023***	***2024…***	***…2030***	***2031***	***2032***
Resource Inflow								
Incremental Revenue from Sale of Maize	***1.05***	**-**	**331.2**	**662.3**	**993.5**	**1,324.7**	**1,324.7**	**1,324.7**
Incremental Change in AR	***1.00***	-	-	-	-	-	-	-
Donors Grant to Project	***0***	-	-	-	-	-	-	-
Maintenance Grant - Government	***0***	-	-	-	-	-	-	-
Residual Value of Irrigation System	***0.81***	-	-	-	-	-	-	407.89
Total Resource Inflow		**-**	**331.2**	**662.3**	**993.5**	**1,324.7**	**1,324.7**	**1,732.5**
Resource Cost								
Construction of Irrigation Facilities	***0.81***	470.49	470.49	470.49	470.49	-	-	-
Cost of Irrigation Facilities Maintenance	***0.99***	-	13.99	20.99	27.98	27.98	27.98	-
Incremental Cost of Certified Seeds	***0.80***	4.83	9.66	14.48	19.31	19.31	19.31	0.00
Incremental Cost of DAP Fertilizer	***0.99***	(10.67)	(21.35)	(32.02)	(42.70)	(42.70)	(42.70)	0.00
Incremental Cost of Urea Fertilizer	***0.99***	5.05	10.10	15.15	20.20	20.20	20.20	0.00
Incremental Cost of NPK Fertilizer	***0.99***	44.42	88.83	133.25	177.66	177.66	177.66	0.00
Incremental Cost of Storage bags	***0.70***	0.00	54.88	109.76	164.64	219.52	219.52	219.52
Skilled Labour	***0.80***	24.00	80.00	96.00	160.00	256.00	256.00	40.00
Unskilled Labour	***0.89***	32.77	60.95	133.62	152.89	77.09	77.09	79.49
Incremental Change in AP	***1.00***	-	-	-	-	-	-	-

Incremental Change in CB	***1.00***	241.27	258.10	274.94	291.77	67.33	67.33	(897.75)
Total Resource Cost		**812.16**	**1025.65**	**1236.65**	**1442.25**	**822.40**	**822.40**	**(558.74)**
NET RESOURCE FLOW		**(812.16)**	**(694.49)**	**(574.33)**	**(448.76)**	**502.25**	**502.25**	**2291.28**

ENPV @ EOCK (11.5%) = 151.31 million Shilling, ERR = 13%

It should be pointed out that a conversion factor of zero implies that the item is a transfer. Items such as taxes, subsidies, grants, etc., are treated as transfers (moving money from one pocket to another) in the economy. Therefore, they are not added to or deducted from the economic resource flow statement.

4. The Role of National Parameters in Public Planning and Appraisal

Unlike the CSCFs, which are specific to commodities and depend on the inputs used up and the outputs produced by the project, national parameters are country specific. These parameters are to be used for all projects in Kenya. They include the economic opportunity cost of capital, foreign exchange premium, and non-tradable outlay (NTP). The following sections discuss each estimated parameter and how they are used to plan and appraise public investment projects.

4.1. Economic Opportunity Cost of Capital

Public investment projects usually last for many years; therefore, the planning and appraisal of such projects require a comparison of the benefits generated by the project and the costs incurred by the project over its entire lifetime. To estimate the PV of project resource costs and benefits, the EOCK is used to discount the project's net resource flow. The term "discount rate" rate, in this case, refers to the time value of the costs and benefits from the viewpoint of the society. For example, suppose the NPV of a project is greater than zero, i.e., the benefits outweigh the resource costs. It implies that the project would generate more net economic benefits than the same resources would have generated if used elsewhere in the economy.

It must be stated that the choice of the discount rate used to estimate the PV of resource costs and benefits is an important decision. This is because different choices can result in entirely different outcomes and, consequently, the decision on whether the project should proceed to the next stage or otherwise. For example, suppose instead of the estimated EOCK of 11.5%, a discount rate of 13% is used to estimate the project economic NPV of the illustrative project. In that case, the project becomes economically unviable with a negative NPV of (50.77) million Shilling. On the other hand, if the discount rate is 10%, the project generates a much higher NPV of 384.85 million Shilling. Therefore, it is important that the same discount rate (EOCK) is used for economic analysis throughout Kenya.

For Kenya, the economic opportunity cost of capital was estimated to be **11.5 percent.** This value is recommended to be used in the economic appraisal of all infrastructure projects in Kenya. Details of the methodology utilized in the estimation are presented in **Annex A.**

4.2. Foreign Exchange Premium and Premium for Non-Tradable Outlays

The other national parameters used to appraise investment projects are Foreign Exchange Premium FEP and the Premium for Non-Tradable Outlays (NTP). These premiums are generated because of trade and other indirect tax and subsidy distortions at the point in time that the funds are raised in the capital market and spent on tradable and non-tradable goods. To effortlessly incorporate FEP and NTP in the economic evaluation of projects, FEP and NTP are expressed as a percentage of the market foreign exchange rate and financial value of non-tradable goods, respectively.

In practice, these parameters are used as inputs in estimating the CSCFs for tradable and non-tradable inputs. They represent some of the distortions that are accounted for when the conversion factors of commodities are estimated. For example, the distortions observed in the market value of urea fertiliser (from the illustrative example) are the FEP and the VAT. Adjusting for these distortions results in a commodity-specific conversion factor of 0.9953.

A change in the value of these national parameters will lead to a different result of the CSCF estimates. The FEP for Kenya was estimated to be **5 percent**, and the NTP **is 1.0 percent.** Details of the methodology used to estimate the FEP and NTP are presented in **Annex A.**

5. Conclusion

The National Parameters Database is a web-based Kenya CSCF database software. This web-based software provides open access to the national parameters and CSCFs for tradable and non-tradable commodities and services. The program provides multiple ways to search and browse the database with a user-friendly interface. It is designed for professionals, policymakers, and academia involved in the economic and social appraisal of public investment projects in Kenya.

Moving from financial analysis to economic analysis is a crucial component of public investment project planning and appraisal. Project Sponsors are expected to accurately demonstrate that the project is economically viable before the project is considered for implementation. The transition to economic analysis involves the estimation of conversion factors used to covert the market values of project input and output to their corresponding economic values. This estimation is technical, tedious, and time-consuming. Therefore, the National parameters database plays a significant role in enhancing the ease with which Project Sponsors conduct economic analysis. The National parameters database provides a compilation of the conversion factors and national parameters that can be directly applied when conducting the economic analysis of projects.

Not only does the National parameters database improve the ease of conducting economic analysis, but it also helps to maintain the integrity of the economic analysis by enhancing its accuracy. For example, the choice of discount rate can significantly impact the economic outlook (in terms of viability) of the project, as a result, impacting the decision-making process. The conversion factor

and national parameters estimates contained in the National parameters database were estimated with a high level of attention, accuracy, and appropriate methodologies were employed.

However, it is worth noting that the National parameters database does not provide the CSCFs for non-tradable outputs, such as roads, water and sanitation, etc. The economic values of such outputs should be estimated individually, using sector-specific guidelines. For example, the benefits of a road project generally arise from the value of time saved due to the project, vehicle operating cost savings, reduction in the number of accidents, etc.

5.1. Recommendations

To reap all the benefits of the National parameters database, attention should be given to the following recommendations:

1. The National parameters database usage should be mandatory for every organ of state involved in public planning and appraisal when conducting the economic analysis of projects. This will ensure that the same parameters are used throughout the country and improve the accuracy of comparing the viability of projects.
2. Detailed cost estimates should be obtained from engineering studies. Different commodities serve as inputs of the project, and each of these commodities has specific conversion factors. For example, instead of obtaining the total capital expenditure of a project from the engineering studies, the Project Sponsor should disaggregate the components of the capital expenditure as much as possible. This will ensure that CSCFs are applied to all the different elements that constitute the capital expenditure and enhance the accuracy with which they are converted from their market values to their corresponding economic values.
3. To complement the National parameters database, it is important that sector-specific guidelines be developed. In addition, government officials should undertake capacity-building programs on how to conduct investment appraisals using the IIA approach and how to use the National parameters database.

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Annexure A: Kenya National Parameters Report

Estimation of the National Parameters for Project Evaluation in Kenya

Final Report

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Executive Summary

In this paper, an analytical framework and a practical approach are developed to measure the economic opportunity cost of capital (EOCK) and the foreign exchange premium (FEP), and the premium for non-tradable outlays (NTP). These national parameters are the essential determinants for practical application to the economic appraisal of investment projects in a consistent manner for a country.

An application of the model is carried out for Kenya since Kenya is a small open economy and is also well integrated into the global capital market. Estimate of the EOCK is based on the hypothesis that when funds are raised in the capital market to finance any investment project, those funds are likely to come from displaced investment, newly stimulated domestic savings, and newly stimulated foreign capital inflows. It can then be estimated as a weighted average of the opportunity cost of each of the three alternative sources of funds. The EOCK is the most appropriate rate used to discount the economic benefits and costs of a project to see if the project is economically viable for society as a whole.

The empirical results generate 11.36% of the EOCK for Kenya in the base case. To ensure the robustness of the estimates, a sensitivity analysis is conducted for the key parameters used in the study. The simulation results range from 9.91% to 12.7% and center around 11.4%. Given the data obtained and used for the analysis, these results suggest that an 11.5 percent real rate is an appropriate and conservative discount rate to use when calculating the net present value of the flows of annual economic benefits and costs over the life of a project.

The foreign exchange premium (FEP) reflects the difference between the economic value of foreign exchange and the market exchange rate owing to the existence of indirect taxes and production subsidies involved in both domestic and external transactions. Likewise, a premium for non-tradable outlays (NTP) is generated because of the set of taxes and subsidies that cause the shadow price of non-tradable goods to be greater or less than their financial values. These premia are quantified and used to convert the financial values of

tradable and non-tradable inputs and outputs into their corresponding economic values for a project's implementation and operation.

The framework for measuring these premiums is based on a three-sector general equilibrium model in an economy, including importable, exportable, and non-tradable goods in which the first two are combined as tradables. The model is further developed into an operational simulation model to capture the distortions associated with changes in demand and supply between the tradable and non-tradable sectors after funds are raised in the capital market and spent on tradable goods and non-tradable outlays.

The model is carried out to estimate the FEP and the NTP for Kenya. In the base case, they are estimated at 5.29% and 0.84%, respectively. A sensitivity analysis is also conducted for the key parameters. The simulation results indicate that the FEP ranges from 4.77% to 5.58%, while the NTP from 0.30% to 1.81%. These results suggest that the reasonable values of the FEP and the NTP for Kenya will be 5.2 percent and 1.00 percent, respectively.

1 Introduction

This study is developed to provide an analytical framework to government organizations and their personnel involved in public investment management with the aim to facilitate the empirical measurement of two national parameters required for the completion of an accurate and consistent economic appraisal or cost-benefit analysis of investment projects in Kenya. These parameters are the economic opportunity cost of capital (EOCK) and the foreign exchange premium (FEP), and the premium for non-tradable outlays (NTP).

The economic opportunity cost of capital (EOCK) is a discount rate used to compare benefits and costs that occur at different times of an investment project to see whether the proposed public project or policy is feasible from the economy's point of view. If, on the one hand, the economic NPV of a project is positive, it is potentially worthwhile to implement the project. This implies that the project increases efficiency or raises the wealth of the country as it produces enough benefits to fully compensate all individuals in the economy. On the other hand, if the NPV is less than zero, the project should be rejected on the grounds that the resources invested would have yielded a higher economic return if they had been left for the capital market to allocate to other uses. The economic discount rate is similar to the concept of the private opportunity cost of capital used to discount the financial cash flows of an investment to find its financial net present value. However, the deviations of financial values from economic values of project costs and benefits may arise from various market distortions that are often created by government interventions such as taxes, subsidies, and price controls or by imperfect competition.

The FEP is needed to convert the financial values of foreign exchange content into its corresponding economic values in order to measure the economic value of tradable goods and services purchased or produced by the project. With the existence of various distortions such as import tariffs, export taxes, production subsidies, and other indirect commodity taxes, the market exchange rate does not accurately reflect the economic value of a unit of foreign exchange in relation to domestic currency. It is this economic (shadow) exchange

rate that should be used to convert the values of tradable goods. This adjustment will ensure that the project's use or generation of foreign exchange adequately reflects the economic opportunity cost of foreign exchange in the country. Likewise, these distortions create a gap between the economic cost of the resources used to purchase non-tradable goods and services employed by a project and their financial values.

Estimates of these parameters depend on Kenya's economic structure and the types and sizes of the taxes and subsidies in its markets. Regarding the employment structure, while the share of the labor force engaged in agriculture is generally declining over the past ten years, agriculture still remains the largest employer of labor, accounting for 54.34% of total employment.[3] In terms of sectoral composition, services remained the dominant sector, accounting for 42.19% of the total value of the economy in 2020. Agriculture has been growing over the last decade and standing now at 35.15% of GDP.[4]

Following the 2014 rebasing of its economy, Kenya is now classified as a lower-middle-income country. In 2019, Kenya's economy was considered the largest economy in East Africa and Central Africa and the third biggest in sub-Saharan Africa (SSA).

The expected economic growth and development path for Kenya is outlined in Vision 2030, a long-term development blueprint for the country. The vision aims to transform Kenya into a newly industrializing, middle-income country that provides a high quality of life to all its citizens in a clean and secure environment.

The economic pillar of the Vision 2030 targets sustained 10 percent annual average GDP growth until 2030, beginning 2012. Although the highest economic growth rate achieved has been so far 8.4 percent during the year 2010, the average growth rate over the period

[3] See, International Labour Organization, ILOSTAT database.
[4] See, The World Bank, World Development Indicators.

2012-2019 has been far below the targeted growth rate with 5.49 percent realized economic growth.[5]

To achieve the desired economic growth, Kenya Vision 2030 and the "Big Four" agenda underscore the need for massive investment and infrastructure projects, including roads, housing, power projects, and health facilities. These investments are projected to be primarily financed by gross national savings. However, the savings level of the country has remained low, maintaining a persistently significant savings-investment gap. [6]

Furthermore, Kenya's government budget has been in deficit over the past decade and a half. Borrowing has been a key resource in financing the budget. Accordingly, Kenya's public debt has been increasing over time and reached the Ksh 5.0 trillion mark in June 2018 and Ksh 5.8 trillion in June 2019, reflecting the government's growing appetite to borrow to fund infrastructure projects across the country.[7]

According to Vision 2030, Kenya needs to boost its total investments to at least 30 percent of GDP. However, the national accounts data show that investment rates fall short of the set targets. For instance, during the first Medium-Term Plan MTP(I), total investments were 20.4 percent of GDP, compared to a target of 25.0 percent, whereas it was 20.1 percent in the second Medium Term Plan MTP (II) against the target of 28.0 percent. The overall investment levels have not sparked the expected economic development, with some major projects listed in Vision 2030 still awaiting completion.[8]

Despite the fact that infrastructure investment makes a significant contribution to national economic growth (Aschauer,1989), the level of investment (quantity) would not translate

[5] Economic growth rates have stagnated at 5.37% in 2019, 6.32% in 2018, 4.81% in 2017, 5.88% in 2016, 5.72% in 2015, and 5.36%, 5.88%, and 4.56% in 2014, 2013 and 2012, respectively. See, The World Bank, World Development Indicators

[6] According to Kenya Economic Report , 2020, the savings-investment gap ranging from 5.3 per cent to 12.1 per cent of GDP for the period 2012 to 2017 but recorded 7.1 per cent in 2018. The savings-investment gap widened to 8.3 per cent of GDP in 2019. These levels of gross national savings are not enough to adequately finance the required investment levels, and hampering and delaying the realization of Kenya's development goals.

[7] See, Kenya Economic Report, 2019.

[8] For the sake of comparison,it is worth mentioning that in 2015 The share of gross fixed capital formation (GFCF) in GDP reached to 34.25% in Tanzania at 2015, and 27.94% in Uganda at 2013.

into faster economic growth rates or a longer-lasting growth effect if the capital productivity (quality) of the investment does not improve. With the existence of a crowding-out effect induced 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. Scaling up the public capital stock in infrastructure, according to Agénor & Moreno (2006), may have a negative impact on growth in the short and medium terms if it crowds out private investment. This short-term impact might be converted into an unfavorable economic effect if the drop in private capital investment sustains over time.

These challenges necessitate enhanced domestic resource mobilization, increasing the importance of the direction of the country's resource allocation and the efficiency of the provision of public infrastructure. Public investments need to be made in a structured, considered manner to prevent inappropriate initiatives, protect Kenya's resources, and ensure that prioritized investments are efficiently implemented. Poor investment decisions commandeer the economy's resources and hinder other important investments, ultimately constraining economic growth.

Governments often have many investment opportunities, and a highly relevant issue is which of these investment opportunities should be adopted. A consensus is that a project's present value is the correct measure of the project's contribution to social welfare. In fact, the present value criterion suggests that any (independent) project can only be adopted if its present value is positive. A key piece of information inside the present value criterion is the discount rate that is used to aggregate benefits and costs over time. In economic project evaluation, we need a discount rate that accounts for existing distortions in capital markets. In other words, we need a social discount rate or, equivalently, a rate of discount capturing the economic opportunity cost of capital. Applying this discount rate in Kenya public projects' economic analysis would help improve investment allocations and project selection processes to ensure that the best investment projects are selected and funded.

Given the limited investment resources available to implement high levels of investment across various sectors, the purpose of discounting in the appraisal of public projects is to choose the rate that best promotes economic efficiency in terms of maximizing net present values of public benefits, such that this rate leads to a selection of more productive project over another that is less productive. This enables the government to cut out inferior projects and invest in those with a potential high yield to meet the Vision 2030 targets and provide the best benefits for the current and future generations.

Improving the growth effect and minimizing the 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 return from the investment in any project must compensate for the weighted economic cost of the sources of the funds used to finance it. This includes the (1) displaced domestic investment, (2) incremental forgone consumption, and (3) in an open economy, paying for the incremental funding sourced 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).

2 Measurement of the Economic Opportunity Cost of Capital (EOCK)

2.1 Alternative Approaches

Implementation of cost-benefit analysis involves the important step of choosing an economic discount rate. Economists are in agreement that a very serious misallocation of

resources can result from the use of an incorrect estimate of the economic discount rate.[9] While methods of estimating market discount rates are well known, the appropriate method of selecting an economic discount rate to be used in evaluating public sector investment projects has been one of the most contentious and controversial issues in this area of economics.

Based on efficiency criteria, methods for determining the economic discount rate are generally placed into three categories.[10] 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 captures the essential features of the above two alternatives by taking 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

[9] See, for e.g., Baumol (1968); Harberger (1969); Burgess (1988).
[10] Social rate of time preference as supported by: (Marglin, 1963), (Feldstein, 1964), (Sen, 1961), (Lind, 1982), (Bradford, 1975). Social opportunity cost of capital advocates by: (Baumol, 1968), (Mishan, 1967), (Diamond, P. & J. Mirrlees.,1971). 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).

foreign savings when the government enters into a borrowing operation in the capital market.

In this study, we apply this weighted average approach using Kenya national accounts and capital market information in order to estimate the appropriate economic discount rates to be used for appraising public investment projects in Kenya.[11] What follows is to describe this approach and empirically measure the economic cost of capital for Kenya.

2.2 Analytical Framework

The estimation of the (EOCK) is based on the view that "the 'marginal' source of funds for both the public and private sectors is usually the capital market (Jenkins & Kuo, 1998). When the sponsor of an investment project enters the capital market and bids for funds, the private demand for funds as well as the domestic supplies of investible funds are likely to respond to a change in market conditions. 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 are attracted to a greater amount of consumption that they can spend in the future by now saving and investing their funds in the capital market.

When we move to an open economy framework, borrowing from the international capital market becomes the third source of funds due to a higher rate of return in the home country. 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 costs of servicing the existing foreign debt where the interest rate on some of the current stock of debt is contracted at a variable interest rate. These debt instruments would be responsive to changes in the market rate of the interest.

[11] This approach has been initially developed by Harberger (1969) and Sandmo & Dreeze (1971).

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 changes in interest rates caused by the government's additional demand for funds. This can be expressed as:

$$EOCK = f_1 * \rho + f_2 * r + f_3 * MC_f \quad (1)$$

Where ρ refers to the gross tax rate of return to domestic reproducible remunerative capital investment, 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 (f_i) represent the share of funds diverted from private sector investors, private sector savers, and foreign savers. The sum of $f1 + f2 + f3$ will equal one.

2.3 Empirical Estimation

Following equation (1), estimating the economic opportunity cost of capital requires the estimation of two components. The first component is presented in section 2.3.1 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 on domestic savings (net of tax), and the marginal economic cost of foreign financing. Section 2.3.2 presents the estimation of shares of these three sources of funds.

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

2.3.1.1 The Gross of Tax Rate of Return on Reproducible Remunerative Capital (ρ)

The gross-of-tax return to reproducible remunerative capital measures the contribution of remunerative capital investment in the economy as a whole. In most estimates of the economic discount rate based on 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 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 measurement of the return to capital can be reached by two main alternative approaches; while the two approaches are using the national accounting system, however, they are 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 estimating by adding up all the returns to capital which includes interest income, dividend income, rent, profit income, as well as the associated direct and indirect taxes generated by capital. The total income accruing to capital is then divided by the stock of reproducible remunerative capital. The second approach is an aggregate and top-down approach.[12] At a conceptual level, if we assume that factor payments exhaust the value of output, we can obtain income accruing to capital as the value of output net of the contributions made by labor, land, natural resources, associated sales, and excise taxes and the gross consumption of fixed capital. According to the availability and types of detailed data recorded in Kenya's national accounts, the second approach is adopted.

The rate of return to reproducible remunerative 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 remunerative capital stock (K_t). with both numerator and denominator expressed in terms of prices of the same year

$$\rho = \frac{Y_t^K}{K_t} \tag{2}$$

[12] 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.

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:

$$Y_t^K = Y_t - Y_t^L \quad (3)$$

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:

$$Y_t^K = Y_t - Y_t^L - pGVA_t^C - S^L T_t - R_t - D_t \quad (4)$$

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 agriculture, 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 reproducible capital stock.

The first step is to estimate 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 of mixed-income that corresponds to the labor income for unincorporated enterprises needs to be estimated and added 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.

The compensation of employees, which represents the lower bound of total labor income in the economy, is available in the national accounts of Kenya; however, this item generally disregards the self-employed income, and without considering this share, the labor income will underestimate the true total labor income share. Therefore, to estimate the total share of labor in national income, one needs to add up the share of labor income of unincorporated businesses to the compensation of employees' items of national accounts.

To determine the total labor income in Kenya, we employ the ILO modelled estimates (2019) of the labor income share in GDP. The ILO estimate provides the ratio of total labor income (after accounting for the labor income of the self-employed) and gross domestic product (a measure of total output), both provided in nominal terms.[13]

According to the data obtained from the ILO dataset, the total share of labor in GDP for Keny ranges between 41.5% to 46% of national income between 2006 to 2019. In the empirical estimations that follow, sensitivity analysis is run to define the effect of changes in the labor income share and on the estimation of EOCK.[14]

The second step is to figure out income accruing to land. As land is not part of reproducible capital, it is not part of the base of our rate of return estimation. This task is not straightforward because we do not have direct information on the income generated by land; however, the land is a production factor contributing significantly to the value-added in the agriculture and housing sectors.[15]

Agriculture is a large sector in Kenya which accounting for about a third of the total value of the economy.[16] According to Harberger (1969) and Robles (1997), one-third of the

[13] Self-employed can be found in the revision of the International Classification of Status in Employment, ILO (1993), and includes – among others – employers, own-account workers and contributing family workers. Employers are self-employed individuals who engage at least one employee on a regular basis. In contrast, own-account workers do not engage employees on a regular basis. Finally, contributing family workers work in an establishment operated by a relative with a limited degree of involvement in its operation.
[14] All data are presented for the total share of labor income is shown in Appendix A.
[15] Disaggregated items of the GVA of housing sector or on the contribution of land to the sector are not available for Kenya. Accordingly, in the absence of detailed information, the housing sector is excluded from this study.
[16] Agriculture, forestry and fishing accounting for 34% of the gross domestic product in 2019.

value-added in the agricultural sector is an income accruing to land.[17] Kenya national data indicates that the gross value added by agriculture in the aggregate sector ranges between 91.56% to 95.17%.[18] Hence, we estimate the land contributions in the agriculture sector to the GDP as (1/3), multiplying by the sum of gross value added of growing of crops and animal production sub-sectors as shown in Appendix A, column (8).

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 give rise to economic rents.

The mining and quarrying sector makes a negligible contribution to the Kenyan economy. The national figures show that the average rate of mining and quarrying output to GDP over 2006 - 2019 is less than one percent.

From 2016 to 2019, the total royalty and natural resource income received by the government from the mining sector fall in a range between 3.1% to 5% of the gross value added of the industry.[19] In the absence of more precise data, we assume that the value of economic rents in Kenya that need to 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 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 study.[20]

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

[17] Fishing and forestry are excluded.
[18] The data is obtained from KNBS, national accounts for 2006 to 2019.
[19] The prevailing royalty rates in Kenya are: Gold, fluospar, diatomite, CO, (5%), Mettalic ores (8%),Titanium (10%), Gemstones (5%), Industrial minerals (1%), and Cement mineral levy 140/= per tonne. Those rates are available at, https://www.petroleumandmining.go.ke/state-department-for-mining.
[20] We assume that the total economic rents of Kenya that need to be deducted from the national income would be 3.5 percent of the gross value added of mining and quarrying sector as presented in Column (9) in Appendix A.

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, Kenya has implemented a value-added tax (VAT) at a rate of 16% currently. These value-added taxes apply to the consumption of goods and services in the economy. VAT is charged at each stage of the production and distribution process, and it is proportional to the price charged for the goods and services. Kenya's government allows 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.

Customs and excise duties are imposed on goods and services manufactured in Kenya or imported into Kenya and specified in the first schedule of the Excise Duty Act (2015). This duty is mainly levied on alcoholic products, cigarettes and tobacco, mineral water, soft drinks and juices, airtime, financial transactions, automobiles, etc.

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 (5) of Appendix A.

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 attributable to the value-added of capital must be added to GDP. To do that, we use the information obtained from the National Government Account, Statistical Abstract publications.

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 economic depreciation expense consumption of fixed capital reported by the national accounts needs to be deducted from GDP, which results in income accruing to the capital net of depreciation.[21]

Another reasonable adjustment that needs to be made to the rate of return calculation is the deduction of some portion of returns to capital in financial intermediation. According to Harberger & Jenkins (2015), when new demands for funds lead to the displacement of other investments, they automatically save the economy the intermediation costs that would normally be linked to those investments. In measuring the returns to the capital for the economy as a whole, such returns that would be received by capital in the financial sector are included. Hence, we need to exclude that part of these returns that are linked to the investments of each period. This will be approximately equal to 6% of the gross private investment of the year when funds are taken from the capital market. For this study, the allowance for investment-related costs of financial intermediation is calculated as the share of capital in the financial sector times 6% of the GFCF of private business enterprises.[22]

To this point, we have estimated the aggregate income that is directly accruing to reproducible remunerative capital throughout the period 2006 - 2019, i.e., gross-of-tax return to capital; the results are shown in Appendix A, Column (13). This income to capital is the remunerative income as captured by the national accounts.

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 study, we identify the price level of 2009 as the base year for Kenya.

Kenya has no official estimates of its capital stock. Therefore, we will construct our estimates. The perpetual inventory method is a method of constructing estimates of the

[21] See, The World Bank, World Development Indicators
[22] We assume that the Capital's share in the GVA in financial sector is 50%.

capital stock and consumption of fixed capital from time series of gross fixed capital formation. More precisely, the method is based on the following relation:

$$K_t = (1 - \delta)K_{t-1} + I_t \quad (5)$$

Where K_t is the stock of physical capital at the end of period t, I_t is the flow of gross fixed investment during period t, and δ is the (exponential) rate of depreciation.

The database of Penn World Table (version .10) provides four categories of gross investment: (a) residential and non-residential structures; (b) machinery and (non-transport) equipment; (c) transport equipment; (d) other assets.[23] Our strategy will be to apply the perpetual inventory method separately to each of these categories.

With respect to depreciation, it is assumed that depreciation rates for machinery and (non-transport) equipment, transport equipment, and other assets are the same at 6 percent in the base case; however, we assume that residential and non-residential structures depreciate at a low depreciate rate of 2.5 percent in the base case.[24]

The initial capital stock, i.e., capital at t = 0, is estimated based on Harberger (1988) approach. This approach employs neoclassical growth theory and relies on the assumption that the economy under consideration is at its steady state. As a consequence of this assumption, capital and GDP grow at the same rate g:

$$K_t = \frac{I_t}{g+\delta} \quad (6)$$

Equation (6) indicates that computing the capital stock in 2006 requires data on investment in 2006 and a representative measure of GDP growth around 2006, and an estimate of the depreciation rate. In particular, the estimated growth rate g was approximated by the average annual growth from 2000 to 2005, 3.14%, as illustrated in Appendix B.

[23] Other assets include software, other intellectual property products, and cultivated assets.
[24] The assumed low and high annual depreciation rates are 2% and 3% for residential and non-residential structures, and 4%, and 8% for the other categories of assets.

Therefore, initial stocks were estimated for each type of reproducible capital given the data on investment provided by the Penn World Table (version .10). Then the total initial reproducible capital stock has been computed for 2006.

Afterward, following equation (5), the capital stock in 2007 is just the initial capital stock computed according to (6) reduced by its real depreciation and augmented by the gross fixed investment in 2007; the subsequent capital values were calculated repeating the same procedure. All details on the construction of the capital stock series are presented in Appendix B.

To estimate the real rate of return on reproducible remunerative capital, we exclude a non-remunerative share of public sector capital such as the investment in roads, schools, and public buildings from the total reproducible capital. The main reason for doing that is the presumption that government investment (and saving) are not responsive to the funds demanded by an incremental public investment project. In other words, it is not likely that there will be any displacement of non-remunerative public sector investment expenditures when the government enters into a borrowing operation in the capital market. Hence, the reproducible remunerative investments that will primarily be 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 public corporations and public-private partnerships; however, a non-remunerative share of general government investment is excluded. (Othman & Jenkins, 2020).

According to the IMF, Investment and Capital Dataset (ICSD),[25] the average proportion of the private-capital stock plus public-private partnership capital stock is about 73% of the total capital stock in Kenya during the period 2006-2019. Accordingly, the capital stock

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

series calculated based on equation 5 is multiplied by this ratio to derive the remunerative capital stock in Kenya.

The real economic rate of return to capital is estimated as the capital's share of national income during a specific year divided by the reproducible remunerative capital stock for that year. For the past fourteen years, the result indicates that the aggregate rates of return on capital in the Kenya economy are high. The average real rate of return (net of depreciation expense) to domestic investment (ρ) over the study period has been 15.18%. This is the rate of return that measures the cost to the economy when the government displaces remunerative investment.

Figure.1 illustrates the estimations of the real rate of return to the reproducible remunerative capital investment of Kenya from 2006 to 2019. The return to total reproducible remunerative capital for the overall economy in Kenya fluctuated from 13.71% in 2006 to 14.03% in 2019, mainly affected by its business cycle.

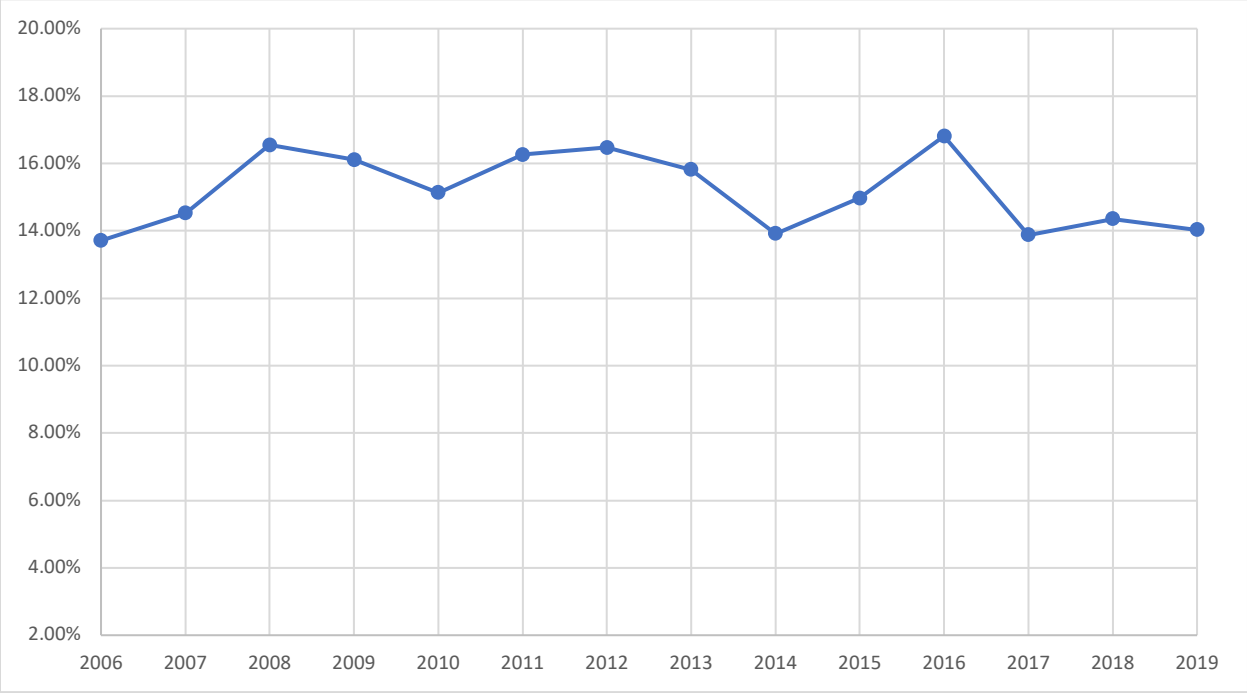

Figure 2 Real Rate of Return to Reproducible Remunerative Capital for Kenya economy: 2006-2019.

2.3.1.2 The Rate of Return on Domestic Savings (r) in Kenya

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.

The net of tax return of domestic savings will be estimated as a gross of tax return to the reproducible capital net of income tax from corporations. In addition to that, the property taxes paid by corporations and householders should be deducted. The reason to do that is these taxes falling on capital and derive a wedge between income accruing to investment and the income accruing to saving.

Finally, the national net of the tax return to domestic savings is deflated by the GDP deflator to express all figures in 2009 prices and then divided by the real values of the remunerative capital stock.[26] The result is the average real rate of return to domestic savings.

Over the study period 2006 - 2019, the return investors receive from newly stimulated domestic savings that are invested in reproducible remunerative investments in Kenya has averaged 13.34%. Detailed calculations and formulas are presented in Appendix C.

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

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

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 the reproducible remunerative investment will reflect their rate of time preference rate between consumption and saving (investing).

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 the tax rate of returns from reproducible remunerative investment estimated above and the risk-free rate adjusted for inflation and personal income tax.[27] 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 the tax rate of return to domestic savings.[28]

Table 1 illustrates the calculation of this rate in Kenya that represents (r) in the calculation of EOCK. The final estimates suggest that the rate of return on domestic savings is 6.67% in real terms.

Table 3 The Real Rate of Return on Domestic Savings (r)

Treasury bill (91 days)	8.76%
The personal income tax rate	15.00%
Treasury bill (net of tax)	7.45%
CPI (YOY%)	9.06%
The real rate of return to a risk-free bond	0.00%
The real primary rate of return to domestic savings	13.34%
Risk premium	6.67%
The real rate of return to domestic savings (r)	6.67%

Source: CBK & IMF.
Notes:
1. Treasury bills & CPI % are the average rate from 2006 - 2019.
2. Risk Premium = [Primary Real Rate of Return on Domestic Savings - A 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].

[27] Treasury bills are considerably risk-free, or at least low risk financial instrument.
[28] It is worth to mention here that a large fraction of people in developing countries are net borrowers not savers. Therefore, the rate of return on postponed consumption should include not only the after-tax rate of return on saving, but also the real rate of return on consumer borrowing. Including this category would increase the rate of return on postponed consumption, and the implied EOCK rate. However, the increase would be quite modest given the small proportion of incremental funding drawn from postponed consumption compared to displaced domestic investment.

2.3.1.3 The Marginal Economic Cost of Foreign Financing (MCf) in Kenya

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. In particular, the higher demand for foreign funds will increase the interest rate faced by the country in the international capital markets, which implies that the higher rate will be paid not only on the extra borrowing demanded by the project but also on all the debt contracted by the country at variable interest rates.

Therefore, for the economy as a whole, the economic cost of foreign borrowing is not given by the interest rate faced by the incremental project, which represents the average cost of borrowing, but by the cost of funds faced by the project plus the extra cost generated on the existing debt, which represents the marginal cost of borrowing.

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.

The marginal cost of foreign borrowing created by the projects can be calculated as follows:

$$MC_f = \frac{[i_f*(1-t_w)-gP_f]}{1+gP_f} * \left[1 + K * \left(\frac{1}{\varepsilon_s^f}\right)\right] \quad (7)$$

Equation (7) indicates that the $\boldsymbol{MC_f}$ is determined by is the average nominal interest rate charged on external loans, i_f, 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.

According to the World Bank, International Debt Statistics, the outstanding amount of long-term external debts of Kenya was at 34,217.10 million US dollars in 2019, in which

30,069.10 million US dollars is held by public and publicly guaranteed institutions. The currency composition of PPG debt shows that the US dollar-denominated long-term PPG debt accounts for 72% on average of the total for the last five years.[29] Accordingly, we consider that gP_f in equation (7) is the GDP deflator of the United States. Taking the average U.S. annual inflation rates throughout the study period, the gP_f equals 1.80%.

Regarding the proportion of foreign financing that is responsive to interest rate changes, World Bank, International Debt Statistics provide the percentage of long-term external debt with interest rates that float with movements in a key market rate. Over the last five years, the variable interest rate accounts for around 31.36% of the external debt stocks in Kenya. For this analysis, we assume that this ratio represents the share of foreign borrowing responsive to interest rate changes (K).

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's long-term average nominal interest rate is about 2.33%.[30] Using Damodaran's (2020) estimation of country risk premium, we obtained the estimated cost of foreign borrowing for Kenya net of withholding tax at 7.66%.[31]

The last component required for equation (7) 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

[29] According to the World Bank, International Debt Statistics, around 75.5% of the long-term external debt in 2019 is denominated in US dollar, 11% in other currencies, 7.3% in Euro, and 4.6% in Japanese Yen.

[30] Source of U.S. Treasury Long-Term Average Rate data is U.S. Department of the Treasury. 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 five year (2016-2020) as we are concerned with the apprising of public project in the future.

[31] It is worth to mention here that Gueye & Sy (2015) estimated the interest rate cost of external borrowing from international capital market for Kenya at 7.65%. 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%.

undertaken to define the effect of changes in this parameter on the estimation of the economic opportunity of capital.[32]

Substitution the parameters and assumptions describe in equation (7), the estimate of the real marginal economic cost of foreign financing (MC_f) for Kenya is at 6.65%.

2.3.2 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 a new investment project in the capital market." For empirical estimation, the relevant formulas of Jenkins & Kuo (1998) can be followed:

$$f_1 = \frac{-\eta(\frac{I_t}{S_t})}{\varepsilon_h^s(\frac{S_d}{S_t}) + \varepsilon_f^s(\frac{S_f}{S_t}) - \eta(\frac{I_t}{S_t})} \tag{8}$$

$$f_2 = \frac{\varepsilon_h^s(\frac{S_d}{S_t})}{\varepsilon_h^s(\frac{S_d}{S_t}) + \varepsilon_f^s(\frac{S_f}{S_t}) - \eta(\frac{I_t}{S_t})} \tag{9}$$

$$f_3 = \frac{\varepsilon_f^s(\frac{S_f}{S_t})}{\varepsilon_h^s(\frac{S_d}{S_t}) + \varepsilon_f^s(\frac{S_f}{S_t}) - \eta(\frac{I_t}{S_t})} \tag{10}$$

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 household savings; in response to the interest

[32] It is worth noting that the elasticity of the supply of foreign funds has two compensating effects: to the extent that it increases the share of foreign funding, yet the marginal cost of these funds decreases.

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 Kenya. 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 in our calculations. 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 Kenya. Hence, one can say that a major part of domestic savings is private-sector savings, and the private-sector investment in Kenya 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. According to recently available data, the ratio of total private-sector investment to total savings would be approximately 77.37% which is used for (It/St) in this analysis.[33]

The amount of foreign investment includes the stock of foreign direct investment (FDI) and the stock of long-term external debt. Using the 2019 figures, the total amount of foreign investment at 2009 constant prices was KES 2,465,672 million (USD 24,171.74 million). This amount was financed through foreign savings. The ratio of this foreign financing to total reproducible capital is about 20.80%. Over the period of this study, the average share of foreign financing to the total reproducible capital (Sf/St) is estimated at 14.31%; thus the 85.69 would be financed by domestic savings. (see Appendix D).

[33] This ratio represents the period from 2015 to 2020. Data are obtained from IMF Country Report No. 21/72. Requests for An Extended Arrangement Under the Extended Fund Facility and An Arrangement Under the Extended Credit Facility—Press Release; Staff Report; And Statement By The Executive Director For Kenya.

With these rations and assumptions, the shares of funds diverted from the three sources described above can be derived. They are 55.16% from displaced or postponed domestic investment, 24.44% from domestic savings, and 20.41% from additional foreign capital Inflows.

2.3.3 Estimates for the EOCK

The estimation of EOCK now is carried out as a weighted average rate of return to displaced reproducible remunerative capital 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 (1), the economic discount rate of Kenya is estimated at 11.36%.

2.3.4 Sensitivity Analysis

One of the challenges for measuring the EOCK for Kenya relates to the availability of data required for estimation. When the data are not available, they are based on our observation of the economic indicators elsewhere. The empirical results in the base case depend on the values of several key parameters, including the share of labor income in GDP, the depreciation rates used for estimating the total capital stock, the percentage share of the remunerative portion of investment in total capital stock, the elasticity of demand for domestic investment, and the supply elasticity of household savings. We conduct a sensitivity analysis regarding the impact of these key parameters on the estimate of the economic opportunity cost of capital.

i. The Share of Labor Income in GDP

If the proportion of labor income in GDP is 3 percent less than the base case illustrated in appendix A (Column 3), the real rate of return to domestic investment would be raised on average to 17.4% over the past fourteen years, and the time preference of consumption to 8.90%. Using 16.9% for ρ, 8.4% for r, and 6.65% for MC_f, the EOCK becomes about 12.7 percent, 1.34 percentage points higher than that for the base case.

On the other hand, if the portion of labor income in GDP is 3 percentage higher than the base case, the average rate of return to domestic investment and the time preference of consumption would be reduced to 13.5% and 5%, respectively. As a consequence, the EOCK decreases to 10.02 percent, which is 1.34 percentage points lower than that for the base case.

ii. Depreciation Rates

a. Annual Depreciation Rate for Residential and Non-Residential Structures

If the depreciation rate used for the capital stock of residential and non-residential structures is 2.0% instead of 2.5%, the parameters ρ and r are calculated to be 14.4% and 6 %, respectively. Substituting these opportunity costs of funds along with 6.65% for MC_f in equation (1) yields the EOCK at 10.76%.

On the other hand, if the depreciation rate is assumed higher at 3.0%, the values of ρ and *r* are estimated higher at 15.9% and 7.3%, respectively, compared to the previous cases. Accordingly, the EOCK would be slightly increased to 11.92 percent, 0.56 of one percentage point higher than that for the base case.

b. Annual Depreciation Rate for Machinery, Transport Equipment, and Other Assets

If the depreciation rate used for the capital stock of machinery, transport equipment, and other assets is 4.0% instead of 6%, the parameters ρ and *r* are calculated to be 13.66% and 5.33%, respectively. Substituting these opportunity costs of funds along with 6.65% for MC_f in equation (1) yields the EOCK at 10.19%.

On the other hand, if the depreciation rate is assumed higher at 8.0%, the values of ρ and *r* are estimated higher at 16.35% and 7.7%, respectively, compared to the previous cases. Accordingly, the EOCK would be increased to 12.26 percent, 0.90 of one percentage point higher than that for the base case.

iii. The portion of Capital Stock Attributable to the Remunerative Capital

If the share of the remunerative portion of capital stock is adjusted upward to 76% of total capital stock from the base case at 73%, the average rate of return to domestic investment falls to 14.6%, so does the time preference of consumption to 6.1%. Using 14.6% for ρ, 6.1% for r, and 6.65% for MC_f, the EOCK is estimated at about 10.90 percent, 0.46 percentage points lower than that for the base case.

Suppose the portion of capital stock attributable to the remunerative is adjusted downward to 70%. The EOCK would be 11.86 percent.

iv. Elasticity of Demand for 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 to 9.91 percent. On the other hand, if the price elasticity of demand for domestic investment is -1.5, the EOCK will increase to 12.19 percent, owing to the larger share of funds diverted from domestic remunerative investment sources.

v. 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 Kenya will increase by 0.65 of one percentage point. However, if this variable is set at 0.6 instead of 0.4, the EOCK will decrease by approximately 0.51 of one percentage point.

From the above sensitivity analyses, we find the estimates of the ECOK range from 9.91 percent to 12.7 percent, as shown in Table 2. Taking into consideration the results of all extreme cases, the average would be 11.3%. Given the data obtained and used for the analysis, these results suggest that an 11.5 percent real rate is an appropriate and conservative discount rate to be used to discount annual real resource costs and economic benefit over the life of an investment project.

Table 4 Results of Sensitivity Analysis for the EOCK for Kenya

Scenarios	Key Assumptions	EOCK
Base Case	− Percentage change in labor income share (%GDP): 0% − Depreciation rate for residential and non-residential structures: 2.5% − Depreciation rate for machinery, transport equipment, and other assets: 6% − Portion of capital stock attributable to the remunerative capital: 73% − Elasticity of Demand for Domestic Investment: -1 − Supply elasticity of household savings: 0.4	11.36%
Sensitivity Analysis:		
− Percentage change in labor income share (%GDP)	+ 3% – 3%	10.02% 12.70%
− Depreciation rate for residential and non-residential structures	2% 3%	10.76% 11.92%
− Depreciation rate for machinery, transport equipment and other assets	4% 8%	10.19% 12.26%
− Portion of capital stock attributable to the remunerative capital	70% 76%	11.86% 10.90%

− Elasticity of Demand for Domestic Investment	-0.50 -1.50	9.91% 12.19%
- Supply elasticity of household savings	0.20 0.60	12.01% 10.85%

3 Measurement of the FEP and NTP

3.1 Introduction

An issue that must be decided before doing any project appraisal has to do with the unit of measurement or numeraire. In principle, economic project analysis can be conducted in domestic or foreign currency and at domestic or border (world) price levels. However, the most common path is to use domestic currency and domestic price levels as the numeraire. This implies that tradable goods and services prices are taken at the world price and converted into domestic currency at an economic price of foreign exchange.

In general, economic prices differ from market prices as a consequence of the pervasive existence of trade and other indirect tax and subsidy distortions. In other words, there are important fiscal impacts that are not captured by a project when funds are taken out from the rest of the economy for the purchase of inputs. The opposite phenomena take place with the production of the outputs of any project.

The standard treatment of the economic price of foreign exchange is based on the thought that when the goods purchased as inputs are tradable goods, it will increase the demand for foreign exchange in the foreign exchange market. The premium on the foreign exchange rate (FEP) needs to be quantified and included in the analysis. However, when resources are used to buy non-tradable (domestic) goods, there is a fiscal impact associated with the non-tradable outlays because of the set of taxes and subsidies that cause the shadow price of non-tradable goods to be greater or less than their financial values.

These actions are repeated many times for each project and are identical for such actions across projects. Therefore, it is more efficient to estimate these variables once for a country and use the same values repeatedly as needed in the appraisal of all projects in Kenya.[34]

These premiums are best expressed as a percentage of the market foreign exchange rate and the financial value of non-tradable goods, respectively. They can be easily incorporated in the economic evaluation of project projects from the analysis of the financial evaluation.[35]

3.2 Analytical Framework

The conceptual framework employed to measure these premiums is based on a three-sector general equilibrium model in an economy developed by Harberger and Jenkins.[36] The three sectors of this model consist of importable, exportable, and non-tradable goods. Both importable and exportable goods are part of tradable goods. [37]

One advantage of the new approach elaborated by Harberger and Jenkins is that it does consider not only internal distortions but also the intratemporal repercussions of the way in which funds of the project (used to buy foreign exchange) are raised so that the incremental demand of foreign exchange will be accommodated not only by movements along the demand and supply of foreign exchange but also by shifts in both curves.

This framework was further developed by Kuo, Salci, and Jenkins into an operational guide and empirically applied to several countries in Africa.[38] This model is employed here to measure the FEP and the NTP for Kenya.

[34] The variables are not estimated in a way to be specific to a particular commodity or project.
[35] See, e.g., Jenkins, G., Kuo, C., & Harberger, (2019)
[36] Harberger, A. C., & Jenkins, (2002)
[37] Importable goods include the goods and services that are actually imported plus the domestically produced goods that are substitutes for these imports. Exportable goods include the goods and services that are produced and could also be consumed domestically. Non-Tradable goods are the goods that are only produced and consumed domestically.
[38] Kuo, Salci, and Jenkins, (2015).

Kenya is open and integrated into the global market economy. When project funds are sourced in the capital market, they are sourced domestically as well as abroad, as described in Section II. If funds are sourced domestically and used to purchase a project's tradable goods, there will be a displacement or postpone of domestic investment and consumption expenditures, which reflect a reduction of demand for domestic tradables and non-tradables. The net result is an excess demand for tradables and excess supply of non-tradables in the economy. The consequence is forgone indirect taxes and subsidies associated with changes in the above expenditures, which reflects an increase in the welfare cost of using the foreign exchange to purchase tradable inputs (i.e., ΔEWt,d).[39]

This will not be the case, however, when funds are sourced abroad and spent on tradable goods as the financing is obtained entirely in foreign currency and since the prices of all tradables are measured in foreign currency, there is no market adjustment when funds are obtained abroad and spent entirely on tradables because there is no excess domestic demand for foreign exchange nor is an excess demand for domestic currency and expenditures (tradable and non-tradable) in the economy. Thus, no additional welfare cost will occur. That is, $\Delta EW_{t,f} = 0$.

Although project funds are initially raised in the domestic market, they will ultimately end with funds sourced domestically and abroad when equilibrium is re-established.

Hence, the impacts of the two market operations create a net welfare cost, which is termed the FEP and can be calculated in a weighted average as follows:

$$\begin{aligned} \text{FEP} &= \omega\text{d} \cdot \Delta EW\text{t,d} + \omega\text{f} \cdot \Delta EW\text{t,f} \\ &= \omega\text{d} \cdot \Delta EW\text{t,d} \end{aligned} \tag{11}$$

[39] Detailed explanation can be found in Kuo, Salci, and Jenkins (2015).

where ωd and ωf stands for the proportions of funds sourced domestically and abroad, respectively.

When project funds are raised in the domestic market but spent on non-tradable goods, the excess demand for non-tradables and excess supply of tradables would occur and generate a net welfare cost. However, if foreign funds are used to spend on non-tradable goods, there is no initial displacement of investment and consumption of tradables and non-tradables owing to the capital extraction. Thus, the excess demand for non-tradables and excess supply of tradables will be greater than the previous case because of a larger impact on the real exchange rate when a new equilibrium is established.[40] The net welfare cost (or NTP) in the economy can be measured by the weighted average of the changes in economic welfare as a result of funds either sourced in the domestic market (ΔEWnt,d) and the foreign market (ΔEWnt,f):

$$\text{NTP} = \omega\text{d} \cdot \Delta EW\text{nt,d} + \omega\text{f} \cdot \Delta EW\text{nt,f} \quad (12)$$

3.2.1 Measuring the Foreign Exchange Premium

To measure the FEP and the NTP, the first is to find out the proportions of project funds sourced domestically and abroad (i.e., ωd and ωf) and to estimate various welfare costs associated with each sourced fund. The proportions of project funds have been dealt with in Section II.[41] This section focuses on how each of the welfare costs can be estimated.[42]

Funds Sourced Domestically are Spent on Tradable Goods

We begin with the net welfare cost when funds are extracted from the domestic capital market to finance the purchase of tradable goods, and then the consequential effect (i.e., substitute effects) will take place due to the impact of changes in the relative price of

[40] When the funds are used entirely to purchase non-tradable goods, these foreign exchanges must be first converted into a domestic currency as the prices of non-tradables are given in domestic currency. Therefore, the demand for tradables will increase and the supply of tradables will decrease as the relative price of non-tradable versus tradable increases.
[41] The sourcing of funds here is consistent with the ones estimated in the EOCK
[42] Most of this section and Sections 3.2.2 are taken from Kuo, Salci and Jenkins (2015). It is presented here for the benefit of readers.

tradable to non-tradable goods. First, when project funds are extracted from the capital markets, this act will reduce the expenditures made by other businesses and consumers on tradables and non-tradables. The decrease in the demand for tradables and non-tradables will reduce the amount of value-added tax (VAT) as well as excise taxes on specific goods and services. In the case of VAT, businesses will be credited for the tax paid on the purchases of business inputs to offset the VAT liabilities from their sales. As a result, only (1- ρi) of the displaced expenditures will affect VAT payments, where ρi refers to the proportion of expenditures during the capital market extraction that is excluded from VAT because of the input tax credit.

The effective VAT rates are different between tradable and non-tradable goods because the portions of their respective goods excluded from VAT differ considerably. If vt and vnt stand for the effective VAT rates on demand for tradables and non-tradables, respectively, only vt (1-ρi) and vnt (1-ρi) of the displaced expenditures from the capital market operation will affect the tax payments. This is shown in the first two terms of equation (13), where $\partial Q_{d,t} / \partial F^D$ and $\partial Q_{d,nt} / \partial F^D$ are the reductions in the demand for tradables and non-tradables as a result of funds sourced through the domestic capital market extraction, ΔF^D. Using the domestic currency as a numeraire, the real exchange rate, *E*, reflects the relative price of tradable to non-tradable goods.

$$\Delta EW_1 = \left[\left(v_t \left(1-\rho_i\right) \frac{\partial Q_{d,t}}{\partial F^D} \right) E + \left(v_{nt} \left(1-\rho_i\right) \frac{\partial Q_{d,nt}}{\partial F^D} \right) + \left(t_{e,nt} \frac{\partial Q_{d,nt}}{\partial F^D} \right) \right] dF^D \qquad (13)$$

In the case of excise duty imposed on selected goods, they are not creditable even if purchased for businesses. This effect is captured in the third term of equation (13). Thus, ΔEW_1 captures the total impact on the welfare cost that is due to changes in VAT and excise duties collected over the process of the extraction of funds from the domestic capital market.[43]

[43] The impact of excise taxes on tradables is captured in equation (15), below.

If the sourced funds are totally spent on tradables, this will initially create a net excess demand for tradables and a net excess supply of non-tradable goods in the economy. This disequilibrium situation will cause a rise in the relative price of tradables to non-tradables; the process will continue until a new equilibrium is reached in which no excess supply exists in the tradables sector owing to adjustments of the real exchange rate. The resources required to produce the additional tradables will come from the reduction in the production of non-tradables. Equilibrium is again established when the sum of the total demand for tradabes (*Qd,t*) and non-tradables (*Qd,nt*) equals the total supply of tradables (*Qs,t*) and non-tradables (*Qs,nt*) plus any of the trade deficit that is financed in the form of remittances, foreign aids and foreign investment.

Given the resource constraint, the above mechanism operates through the adjustment in the real exchange rate.[44] As a consequence of the adding-up properties of demand in a two-good economy, the compensated own-price elasticity of demand for tradables $\left(\eta_t^d\right)$ must be equal to the compensated cross-price elasticity of demand for non- tradables $\left(\eta_{nt}^d\right)$ times the ratio of the demand for non-tradables to tradables (*Qd,nt /Qd,t*). Similarly, for the supply side, the own-supply elasticity (ε_t^s) should be equal to the cross-supply elasticity of non-tradables (ε_{nt}^s) multiplied by the ratio of the supply of non-tradables to tradables (*Qs,nt /Qs,t*).

Since the change in the real exchange rate is required to restore equilibrium in the markets, a change in welfare cost will come about by the interaction of tax and subsidy distortions with the changes in the quantities demanded and supplied. These substitution effects on the welfare cost can be measured by equation (14). The first term refers to the change in VAT collected and subsidy on production in the tradable goods, while the second term is the change in VAT and excise taxes collected and subsidy on production in the non-tradable goods sector.

[44] Alternatively, there will be an excess supply of tradable goods if the funds are all spent on non-tradable goods. The case will be presented in the next section.

$$\Delta EW_2 = \left[\left(\frac{v_t(1-\rho_s)\eta_t^d}{\varepsilon_t^s - \eta_t^d} - \frac{k_t\varepsilon_t^s}{\varepsilon_t^s - \eta_t^d}\right)E + \left(\frac{v_{nt}(1-\rho_s)\eta_{nt}^d}{\varepsilon_t^s - \eta_t^d} + \frac{t_{e,nt}\eta_{nt}^d}{\varepsilon_t^s - \eta_t^d} - \frac{k_{nt}\varepsilon_{nt}^s}{\varepsilon_t^s - \eta_t^d}\right)\left(\frac{Q_{d,nt}}{Q_{d,t}}\right)\right]\left(1 + \frac{\partial Q_t}{\partial F^D}\right)dF^D \quad (14)$$

where K_t and K_{nt} are the production subsidies on tradables and non-tradables, respectively; and ρ_s is the proportion of the changes in demand resulting from the exchange rate adjustment that is excluded from VAT.

In addition to the domestic VAT and excise taxes, there are other external trade distortions, such as import duties, excise duties, and export taxes associated with changes in imports and exports. The effects of these changes on welfare cost over the capital extraction are measured by the third component (ΔEW_3):

$$\Delta EW_3 = \left[\left(t_m \frac{\partial Q_{d,i}}{\partial F^D}\right) + \left(t_e(1+t_m)\frac{\partial Q_{d,i}}{\partial F^D}\right) + \left(t_x \frac{\partial Q_{d,e}}{\partial F^D}\right)\right](E)dF^D \quad (15)$$

where t_m is the effective import duty rate, t_x is the effective export tax rate, t_e is the effective excise tax rate on tradable goods. Qd,i is the demand quantity of importable goods, and Qd,e is the quantity of exportable goods demanded domestically.

The fourth component (ΔEW_4) accounts for welfare cost caused by trade distortions due to the substitution effects. This can be measured in equation (16):

$$\Delta EW_4 = \left[\left(\frac{t_m\eta_M^d\left(Q_M^d / Q_{d,t}\right)}{\varepsilon_t^s - \eta_t^d}\right) + \left(\frac{t_e(1+t_m)\eta_M^d\left(Q_M^d / Q_{d,t}\right)}{\varepsilon_t^s - \eta_t^d}\right) - \left(\frac{t_x\varepsilon_X^s\left(Q_X^s / Q_{s,t}\right)}{\varepsilon_t^s - \eta_t^d}\right)\right](E)\left(1 + \frac{\partial Q_{d,t}}{\partial F^D}\right)dF^D \quad (16)$$

where ε_X^s is the own-price supply elasticity of exports, η_M^d is the own-price demand elasticity of imports, Q_X^s is the amount of exports, and Q_M^d is the amount of imports.

Suppose the amount of funds raised in the economy is one unit of a foreign country, the FEP can be measured by substituting the welfare costs calculated from equations (13), (14), (15), and (16) into equation (11) as follows:

$$\text{FEP} = \omega_d \cdot [\Delta EW_1 + \Delta EW_2 + \Delta EW_3 + \Delta EW_4] \quad (17)$$

3.2.2 Measuring the Premium for Non-tradable Outlays

The NTP is a premium equivalent to the FEP that is associated with non-tradable outlays. It is the amount in which the economic cost of non-tradable outlays exceeds the financial outlays. What follows is to estimate the forgone taxes or welfare cost as a result of raising each of the funds sourced either domestically or abroad.

Domestic Funds are Spent on Non-tradable Goods

In this case, the initial impacts of the capital extraction will have the same effects as expressed in equations (13) and (15) for the estimation of the FEP.

When funds are spent on non-tradables, there will be an excess demand for non-tradables and an excess supply of tradables. This will cause the relative price of non-tradables to tradables to increase. The adjustment process will continue until the excess demand for non-tradables is eliminated.

The impacts on economic welfare due to the substitution effects are two-fold. The first is the change in welfare cost (ΔEW_5) associated with changes in the demand and supply of tradable goods whose markets contain domestic indirect taxes and production subsidies and the second effect (ΔEW_6) is associated with changes in imports and exports that are subject to external trade taxes. They can be measured as follows:

$$\Delta EW_5 = \left[\left(\frac{v_t(1-\rho_s)\eta_t^d}{\varepsilon_t^s - \eta_t^d} - \frac{k_t\varepsilon_t^s}{\varepsilon_t^s - \eta_t^d}\right)E + \left(\frac{v_{nt}(1-\rho_s)\eta_{nt}^d}{\varepsilon_t^s - \eta_t^d} + \frac{t_{e,nt}\eta_{nt}^d}{\varepsilon_t^s - \eta_t^d} - \frac{k_{nt}\varepsilon_{nt}^s}{\varepsilon_t^s - \eta_t^d}\right)\left(\frac{Q_{d,nt}}{Q_{d,t}}\right)\right]\left(\frac{\partial Q_t}{\partial F^D}\right)dF^D \quad (18)$$

$$\Delta EW_6 = \left[\left(\frac{t_m\eta_M^d\left(Q_M^d / Q_{d,t}\right)}{\varepsilon_t^s - \eta_t^d}\right) + \left(\frac{t_e(1+t_m)\eta_M^d\left(Q_M^d / Q_{d,t}\right)}{\varepsilon_t^s - \eta_t^d}\right) - \left(\frac{t_x\varepsilon_X^s\left(Q_X^s / Q_{s,t}\right)}{\varepsilon_t^s - \eta_t^d}\right)\right](E)\left(\frac{\partial Q_{d,t}}{\partial F^D}\right)dF^D \quad (19)$$

The total welfare cost, in this case, can be measured by the sum of ΔEW_1, ΔEW_3, ΔEW_5, and ΔEW_6.

Foreign Funds are Spent on Non-tradable Goods

When foreign funds are sourced, there is no impact on the domestic economy. Until the funds are spent on non-tradables, an additional demand for non-tradables will cause an increase in the relative price of non-tradables to tradables. The impact in this case is greater than when funds are sourced domestically and spent on non-tradables, since there is no initial displacement of domestic investment and consumption in non-tradable goods to be offset. Consequently, the supply of non-tradables will expand much more, demanding greater resources to come to the sector from the tradable good sector.

There is only a substitution effect in this case. These effects can be separated into two parts. The first is the change in welfare cost (ΔEW_7) associated with changes in quantities of items that have domestic taxes and production subsidies levied on them, while the second part (ΔEW_8) is the change in trade taxes associated with the changes in demand and supply of tradable goods when these goods cross borders. These effects can be calculated as equations (20) and (21), respectively:

$$\Delta EW_7 = \left[\left(\frac{v_t(1-\rho_s)\eta_t^d}{\varepsilon_t^s-\eta_t^d}-\frac{k_t\varepsilon_t^s}{\varepsilon_t^s-\eta_t^d}\right)E+\left(\frac{v_{nt}(1-\rho_s)\eta_{nt}^d}{\varepsilon_t^d-\eta_t^d}+\frac{t_{e,nt}\eta_{nt}^d}{\varepsilon_t^s-\eta_t^d}-\frac{k_{nt}\varepsilon_{nt}^s}{\varepsilon_t^s-\eta_t^d}\right)\left(\frac{Q_{d,nt}}{Q_{d,t}}\right)\right]\left(\frac{\partial Q_t}{\partial F^F}\right)dF^F \quad (20)$$

$$\Delta EW_8 = \left[\left(\frac{t_m\eta_M^d\left(Q_M^d/Q_{d,t}\right)}{\varepsilon_t^s-\eta_t^d}\right)+\left(\frac{t_e(1+t_m)\eta_M^d\left(Q_M^d/Q_{d,t}\right)}{\varepsilon_t^s-\eta_t^d}\right)-\left(\frac{t_x\varepsilon_X^s\left(Q_X^s/Q_{s,t}\right)}{\varepsilon_t^s-\eta_t^d}\right)\right](E)\left(\frac{\partial Q_{s,t}}{\partial F^F}\right)dF^F \quad (21)$$

The total welfare cost, in this case, is simply the sum of ΔEW_7 and ΔEW_8.

Since the funds used for the projects are sourced domestically as well as abroad, the NTP should be estimated as a weighted average of the welfare costs associated with each source

of funds. This can be done by substituting the welfare costs calculated from equations (13), (15), (18), (19), (20), and (21) into equation (12). That is:

$$\text{NTP} = \omega\text{d} \cdot \Delta EW_{\text{nt,d}} + \omega\text{f} \cdot \Delta EW_{\text{nt,f}}$$

$$= \omega_{\text{d}} \cdot [\, \Delta EW_1 + + \Delta EW_3 + \Delta EW_5 + \Delta EW_6 \,] + \omega_{\text{f}} \cdot [\, \Delta EW_7 + \Delta EW_8 \,] \qquad (22)$$

3.3 Empirical Estimation

The analytical framework and equations for measuring the FEP and NTP were presented in the previous section. We need to estimate all variables for Kenya. They can be grouped into four categories. The first is the proportion of funds sourced domestically and abroad in order to finance the purchase of tradable and non-tradable goods. The second is the relative sizes of tradable and non-tradable goods in order to measure the interrelated impacts between tradable and non-tradable sectors. The third is the demand and supply elasticities of imports, exports, and non-tradable goods with respect to the real exchange rate. The last is the effective tax rate for each of the major indirect taxes and the effective rates of production subsidies.

3.3.1 Alternative Sources of Funds

The source of funds used to finance projects has a significant impact on the estimated values of the FEP and the NTP. This is due to the fact that if sourced in the domestic capital market, the funds will displace expenditures on investment and final consumption, whereas no such displacement of expenditure occurs if the funds are sourced abroad.

As shown in Section II, when funds are raised in the capital market in Kenya, the proportions of funds diverted to finance investment projects in the base case are 24.44% from domestic savings, 55.16% from displaced domestic investment and 20.41% from foreign savings. The first two components constitute domestic sources of funds, while the third component represents the foreign source of funds. In other words, *ωd* and *ωf* are 79.59% and 20.41%, respectively, for equations (11) and (12).

3.3.2 Tradables vs Non-tradables

The relative size of tradable and non-tradable goods in the economy has important implications for the FEP and the NTP because of the different scope of VAT and other product taxes imposed on these goods and services. At present, the agriculture and industry sectors account for 35.15% and 16.17% of GDP, respectively, in Kenya.[45] Virtually all of these products are moveable and tradable. The service sector is the biggest sector in which trade, restaurants, hotels, information and communication, professional services, and associated transportation and food service activities account for approximately 19.7% of GDP, and many of these services are closely related to tradable goods.

For the country as a whole, we have estimated that the tradable and non-tradable goods in Kenya are approximately two-thirds and one-third, respectively. This is in line with an estimate based on the economy for South Africa using data with a detailed commodity breakdown.[46]

Like most African countries, Kenya has been in a trade deficit position for years. According to World Bank national accounts data, the trade balance in Kenya is on average (-11.71%) of GDP over the period of this study.[47] This suggests that the share of the demand for importables is much greater than that of exportables, and thus, the importable demand is assumed to represent a much greater share of total tradables than exportable demand. For the purpose of this study, the demand for importables as a share of total demand for tradables in an economy is assumed to be 80%, while the domestic supply of importables as a share of a total supply of tradables is 35%. This implies that the proportion of the domestic demand and the supply of exportables in the total demand and supply of tradables would be 20% and 65%, respectively.[48]

[45] World Bank, World Development Indicators (2020).
[46] See, e.g., Harberger, Jenkins, Kuo and Mphahlele (2003).
[47] See, https://data.worldbank.org/indicator/NE.RSB.GNFS.ZS?locations=KE
[48] The latest available Supply and Use Tables, 2017 for South Africa, shows that the domestic supply of importables as a share of a total supply of tradables is 49%. We would expect that this share to be smaller in Kenya because of a lesser open and economic development.

With regard to assessing the impact on the economy of the capital extraction alone, the proportion of importables can be more than the 80% that is assumed for the economy as a whole because tradable goods make up a larger share of total investment. In Kenya, of the displaced investment business, inputs such as motor vehicles, machinery, telecom equipment, and others are all imported. Accordingly, the demand for importables as a proportion of the total demand for tradable capital formation could be as high as 95%, or 85%, at a conservative estimate. Thus 90% of displaced investment is assumed to be importable. As regards tradable consumption, 80% is assumed to be importables, the same proportion as for the economy as a whole. According to Section II, about 55.16% of funds are sourced from the displacement of investment and 24.44% from consumption forgone in response to stimulated household savings over the capital extraction. Hence, about 86.93% of the total change in the demand for tradables caused by the capital market extraction would be importable.[49]

3.3.3 Demand and Supply Elasticities

The demand and supply elasticities of tradable or non-tradable goods are important for quantifying the response of their demand and supply to the relative price of tradable to non-tradable goods (or the change in the real exchange rate). Given the resources available in the economy, in order to ensure the market equilibrium, the derived compensated own-price elasticity of demand for tradables must be equal to the compensated cross-price elasticity of demand for non-tradable multiplied by the ratio of the demand for non-tradables to the demand for tradables. The cross-price elasticity of the supply of non-tradables multiplied by the ratio of the supply of non-tradables over the supply tradables is equal to the negative of the own-price supply elasticity of tradables.

Precise estimates of demand (or supply) elasticities of tradables and non-tradables are not readily available in the literature. But the sum of the own-price elasticities of demand for

[49] This is estimated as a weighted average of importables as a share of total demand for tradables of both household consumption expenditures and business investment. That is, 86.93% = (0.2444* 80% + 0.5516*90%)/ (0.2444 + 0.5516) = 0.3070*80% + 0.6931*90%.

tradables and non-tradables must be equal to the elasticity of substitution (defined negatively) between tradables and non-tradables.

For the purpose of this study, we consider it reasonable to assume an elasticity of substitution of -1.0 between the use of tradables and non-tradables in the economy. In this world of two composite goods, the own-price elasticities of demand will be inversely proportional to their shares in total demand. Hence, if the share of tradables is 2/3 and the share of non-tradables is 1/3 of the total demand and the elasticity of substitution is equal to -1.0, then when trade is balanced, the own-price elasticities of demand for tradables and non-tradables must equal -0.33 and -0.67, respectively.

However, the size of the trade deficit in a country will expand the country's expenditures on tradable goods and hence requires an adjustment to the relative size of the two own-price elasticities of demand. The reverse is true for a trade surplus. According to the current account of the balance of payments information, Kenya had a trade deficit over the period from 2006 to 2019 ranging from 8.9% to 17.2% of gross domestic product. The own-price demand elasticity of tradables is adjusted slightly from –0.33 to –0.295, and the own-price elasticity of demand for non-tradables will become –0.705. On the supply side, the price elasticities of supply of exportables and importables are assumed to be +1.0, while the own-price supply elasticity of tradables $\left(\varepsilon_t^s\right)$ will also be +1.0.

In order to quantify the effects on the amount of import duties and export taxes, we need to determine the compensated own-price elasticity of demand for imports $\left(\eta_M^d\right)$ and the supply elasticity of exports $\left(\varepsilon_X^s\right)$.

The simple and weighted averages of import demand elasticity were estimated for Kenya at -1.89 and -1.14 by Kee, H. L *et al.* (2008). For the purpose of this study, we assume that the import demand elasticity for Kenya is a midpoint between those two averages at -1.52. The export elasticity of supply as estimated by Tokarick (2014) represents the average long-run export supply elasticity adjusted to include the general equilibrium effects of price

changes. For Kenya, the supply elasticity of exports is calculated at 0.57. A sensitivity analysis will be undertaken for these key variables later.

3.3.4 The Effective Tax and Subsidy Rates

The major distortions involved in the estimation of the FEP and the NTP for Kenya include customs/import duties, export levy, VAT, excise duty, and subsidies provided by the government to producers. Instead of statutory tax rates, the ratios of actual taxes collected, or the amount of subsidies provided represent the effective rates of these distortions in the economy and are used to measure their impacts on welfare cost.

Import Duty

The effective import duty rate is calculated by dividing the total import duty collections by the amount of imports at cost, insurance, and freight (CIF) value.

Kenya is a member of the East African Community (EAC), the Common Market for Eastern and Southern Africa (COMESA), and the Intergovernmental Authority on Development (IGAD). EAC is a customs union with duty-free intra-EAC trade and a common external tariff (CET). The EAC member states (Burundi, Rwanda, South Sudan, Kenya, Uganda and Tanzania) also adopted a Common Market Protocol in 2009, which came into effect in 2010. However, the Protocol has not yet been fully implemented.

Kenyan imports from the EAC and COMESA countries (except DRC, Eritrea, Ethiopia, Somalia, and Tunisia, which are in the process of acceding to the COMESA FTA) enter duty-free. Imports from outside EAC and COMESA have levied the MFN applied duty (i.e., EAC Common External Tariff). The EAC Common External Tariff (CET) relies on three bands: 0% (mainly applicable to raw materials and capital goods, but also to some species of live animals, organic chemicals, and pharmaceutical products), 10% (for intermediate goods), and 25% (for final goods). Furthermore, Sensitive items Attract a duty

higher than 25% and can reach up to 100% (ex. sugar), 75% (rice), 60% (milk and cream, cheese, and other dairy products), or 50% (woven fabric). [50]

In order to calculate import tariff rates, the custom duties revenues were collected from the Kenya National Bureau of Statistics (Statistical Abstract), whereas the value of imports of goods at the CIF price was obtained from the Central Bank of Kenya dataset.

The average effective import duty rate for Kenya is calculated at 4.62% over the past fourteen years, ranged from the lowest rate of 3.5% in 2011 to the highest rate of 6.70% in 2019, as shown in Table 3. For the purpose of this study, 4.62% is used for t_m in the model simulation.

Table 5 Effective Tax Rates of Import in Kenya

	Millions of KSh		
Year	Imports of goods (CIF)	Import duties	Import Tariff
2006	526,868	20,511.43	3.89%
2007	605,121	27,927.00	4.62%
2008	766,742	32,944.35	4.30%
2009	788,096	36,180.60	4.59%
2010	959,434	40,600.00	4.23%
2011	1,315,656	46,071.81	3.50%
2012	1,376,804	51,711.78	3.76%
2013	1,408,808	57,649.69	4.09%
2014	1,618,454	67,554.64	4.17%
2015	1,580,330	74,047.72	4.69%
2016	1,432,425	79,187.93	5.53%
2017	1,725,623	89,943.34	5.21%
2018	1,757,982	93,921.45	5.34%
2019	1,800,962	120,589.17	6.70%

Sources: Statistical Abstract, Kenya National Bureau of Statistics, Nairobi.
Central Bank of Kenya.

Export Tax

An export levy is imposed on all goods specified in the First Schedule as outlined in the First Schedule of the Miscellaneous Fees and Levies Act of 2016. The levy shall be

[50] All sensitive items are listed in the schedule 2 of the EAC Common External tariff (p:492-p:495).

paid at the time of entering the goods for export to countries outside the East Africa Community (EAC). The levy shall be based on both an ad valorem regime and a hybrid tax regime (including both specific and ad valorem rates). Where the rate is ad valorem, it will charge on the customs value of the goods. The Commissioner shall adjust the specific rate of export levy annually to take into account inflation in accordance with the formula specified. Goods under the first schedule are generally classified under raw hides and skins at the rate of 80% or USD0.52 per Kg, and under waste and scrap metal at the rate of 20%.

The effective export tax rate is calculated as the ratio of the amount of export tax to the total amount of exports at free on board (FOB) value. The amount was small, as shown in Table 4; the effective export tax rate was estimated at 0.013% for the period 2017-2019. For the purpose of this study, 0.013% is used for t_x in the model.

Table 6 Effective Tax Rate of Export in Kenya

	2017	2018	2019
Export levies (million KSh)	60.83	79.72	88.41
Total exports (F.O.B) (million KSh)	594,128	612,878	595,379
Effictive export tax rate	0.010	0.013	0.015

Value Added Tax

Value Added Tax (VAT) is a consumption tax charged on the supply of taxable goods and services made in Kenya and the importation of taxable goods or services made into Kenya. Value-Added Tax is levied at each stage of the production and distribution chain as value is added. The general rate of the VAT system is 16%, and it is intended to tax all consumption of goods and services except those that are exempt or zero-rated and certain supplies subject to a flat rate of 8% (for petroleum oils obtained from bituminous, motor spirits).

The current threshold for compulsory VAT registration is 5 Million per annum, which implies that the transaction of enterprises under the threshold are outside the tax system and classified as exempt supplies.[51]

Some certain supplies are zero-rated. Goods listed in the 2nd Schedule to the VAT Act, such as the exportation of goods or services, goods supplied to Export Processing Zones (EPZ), and the supplies to Priviledged persons and Public bodies, are zero-rated supplies.

As mentioned above, certain goods and services are exempt supplies. These are supplies of goods and services on which VAT is not charged either at the standard or zero rates. If a business produces only exempt supplies, it cannot register as a VAT vendor, and therefore, it cannot charge VAT on those supplies. Furthermore, any VAT the business incurs to produce exempt supplies cannot be deducted as input tax. The supplies specified in the First Schedule of the VAT Act are not subject to tax.

Consumers may benefit more from the zero-rating of goods and services than from exempt supplies. This is because input VAT on zero-rated supplies is claimed as an input cost by the VAT vendor, and VAT is levied at zero percent (effectively no VAT) on the sales made by the VAT vendor. In contrast, input VAT on exempt supplies may not be claimed, and output VAT may not be levied on exempt sales. The cost to the vendor of procuring goods and services in exempt supplies is, therefore, higher than the cost of supplies in zero-rated sales. As a result, such input taxes are expected to be shifted forward to final consumers at higher prices or embodied in the prices of goods or services. This tax is reflected in the effective tax rate of non-tradable goods and services.

The effective tax rate for VAT is calculated as the ratio of VATs collected to total household final consumption expenditures. It is expected to be lower than the standard statutory rate owing to exempted and zero-rated goods and services. As described above,

[51] Voluntary registration is allowed for traders with taxable supplies below the 5 Million thresholds.

most tradable goods are levied at the standard rate with the exception of some certain goods. For the non-tradable good sector, a great proportion of services are exempt.

Given the approximate sizes of tradables and non-tradables at 67% and 33% of total consumption, and assuming the proportions of tradable goods and non-tradable goods that are subject to the VAT are assumed at 85% and 20%, respectively, the weighted average of the effective VAT rate for Kenya as a whole is expected to be 10.17% = [(0.67*0.85 + 0.33*0.20) *16%], which is almost two-third of the statutory rate.

This figure is far greater than the total effective VAT rate over the past fourteen years, as shown in Table 5, due to a huge informal economy as well as a substantial amount of tax avoidance and evasion. According to (Medina et al., 2017), the informal economy accounts for between 30% - 40% of GDP. With such a huge informal economy plus tax avoidance and evasion, one would expect to have a significant amount of non-compliance of taxes.

The average effective VAT rate was estimated at 5.48% over the past fourteen years. This suggests that the compliance ratio of the VAT system in Kenya would be around 53.85%. With this estimated compliance rate, we can estimate the effective VAT rate for tradable goods (vt) at 7.32% and for non-tradable goods and services (vnt) at 1.72%.

Table 7 Effective VAT Rates

	Millions of KSh				
Year	Final consumption expenditure by households	VAT on domestic goods and services	VAT on imported goods and services	Total Total Amount of Tax Collected	Effective VAT Rate
2006	1,419,482.05	46,093	33,833	79,926	5.63%
2007	1,610,397.23	51,341	45,156	96,497	5.99%
2008	1,870,440.25	58,277	53,628	111,905	5.98%
2009	2,183,634.18	66,216	60,638	126,854	5.81%
2010	2,445,340.62	75,673	72,680	148,353	6.07%
2011	2,935,943.99	90,211	81,670	171,881	5.85%
2012	3,355,111.98	81,496	94,891	176,386	5.26%
2013	3,831,452.98	90,714	94,202	184,916	4.83%
2014	4,316,539.46	107,737	124,893	232,630	5.39%

2015	4,955,073.05	127,905	131,781	259,685	5.24%
2016	5,536,202.69	160,389	128,824	289,213	5.22%
2017	6,666,111.40	194,234	144,800	339,034	5.09%
2018	7,324,881.37	206,257	150,599	356,856	4.87%
2019	8,035,405.17	242,919	192,966	435,886	5.42%

Sources: Statistical Abstract, Kenya National Bureau of Statistics, Nairobi.

In addition, we are dealing with two operations in the general equilibrium analysis setting: funds extracted from the capital market and the substitution effects on the quantities demanded and supplied in response to the real exchange rate. The incidence of a consumption-type VAT will be borne through the consumption portion of the demand for goods because taxes paid on intermediate inputs and capital goods purchased by businesses are all refundable. For Kenya, we assume that the proportion of the change in demand that is excluded from VAT as a consequence of the substitution effect is 60% for ρ_s, based on the estimate made for South Africa. In the case of capital extraction, the coefficient is much higher at approximately 85% for ρ_i.[52]

Excise Duty

In Kenya, excise taxes have been levied specifically for meeting the revenue requirements of the government. This duty is imposed on particular goods and services manufactured in Kenya or imported into Kenya and specified in the first schedule of the Excise Duty Act (2015), such as alcoholic products, cigarettes and tobacco, mineral water, soft drinks and juices, airtime, financial transactions, automobiles e.t.c.

The taxation base of excise duty is the ex-factory price for locally produced goods and the c.i.f. price for imported goods. With the general hypothesis of fully shifted forward sales tax, the effective excise duty rates are estimated based on the final consumption

[52] The 60% and 85% were based on estimates in which the sum of intermediate inputs plus capital investment to the total output in South Africa for 1998. See Statistics South Africa (1998).

expenditures of households. They are shown in Table 6. The average rate (te) for the period 2006-2019 was about 2.74%, which is used for measuring the FEP and NTP.[53]

Table 8 Effective Excise Duty Rates

	Millions of KSh		
Year	Final consumption expenditure by households	Excise Duties on Goods and Services	Effective Excise duty rate
2006	1,419,482.05	46,646	3.29%
2007	1,610,397.23	56,123	3.49%
2008	1,870,440.25	61,906	3.31%
2009	2,183,634.18	69,872	3.20%
2010	2,445,340.62	78,066	3.19%
2011	2,935,943.99	80,567	2.74%
2012	3,355,111.98	78,884	2.35%
2013	3,831,452.98	85,660	2.24%
2014	4,316,539.46	102,029	2.36%
2015	4,955,073.05	115,872	2.34%
2016	5,536,202.69	139,540	2.52%
2017	6,666,111.40	165,474	2.48%
2018	7,324,881.37	167,777	2.29%
2019	8,035,405.17	210,091	2.61%

Sources: Statistical Abstract, Kenya National Bureau of Statistics, Nairobi.

Production Subsidy

In some countries, subsidies are provided to enterprises, resident producers, or importers. Subsidies are used to finance additional resources that enable producers to compete in domestic or international markets. The effective subsidy rate is calculated by taking the total amount of subsidies and dividing it by gross domestic product at factor cost, with the assumption that subsidies are provided equally between tradable and non-tradable good sectors.

[53] With the same definition of tradable and non-tradable goods assumed previously, all excisable goods are considered tradable goods. Thus, the effective excise duty rates for non-tradable goods is assumed to be zero.

For the purpose of calculating the subsidy rate on tradable and non-tradable production, we use subsidies on production data available at the national government account in the statistical abstract publications. The average share of these subsidies in GDP at factor cost is estimated at 0.42%.[54]

3.3.5 Measuring the FEP and the NTP

The key parameters and assumptions outlined above and listed in Table 7 are used to estimate the FEP and the NTP for Kenya.

Table 9 Key Parameters and Effective Tax and Subsidy Rates

Categories	Parameters
Funds Sourced domestically: $\partial F^D/\partial F$	79.59%
Funds Sourced from the foreign capital market $\partial F^F/\partial F$	20.41%
Demand Shares of Importables in Total Tradables:	
Capital Extraction: $\partial Qd,i/\partial Qd,t$	86.93%
Substitution Effects: $\partial Qd,i/\partial Qd,t$	80.00%
$\partial Qd,e/\partial Qd$,t	35.00%
Own-price Demand and Supply Elasticities:	
Compensated Own Price Elasticity Demand for Imports: (η_M^d)	-1.515
Own Price Supply Elasticity of Exports: (η_X^d))	0.570
Supply of Importables: ($\varepsilon_{s,i}$)	+1.00
Supply of Exportables: ($\varepsilon_{s,i}$)	+1.00
Demand elasticity of tradable: ($\eta_{d,t}$)	-0.295
Demand Exclusion from VAT:	
During the Initial Capital Market Extraction: (ρ_i)	85.00%
During the Exchange Rate Effect: (ρ_s)	60.00%
Effective Tax and Subsidy Rates:	
Effective Import Tariff Rate on Imports: (t_m)	4.62%
Effective Export Tax Rate: (t_x)	0.013%
Effective VAT Rate on Tradables: (v_t)	7.32%
Effective VAT Rate on Non – Tradables: (v_{nt})	1.72%
Effective Ad Valorem Excise Tax Rate on Tradables:(t_e)	2.74%
Subsidy Rate on Tradable Production: (k_t)	0.42%
Subsidy Rate on Non - Tradable Production: (k_{nt})	0.42%

[54] GDP at factor cost is obtained from national accounts data provided by KNBS.

Substitute these parameters and effective tax and subsidy rates into the equations (13) – (16) and (18) – (21) will generate each of the welfare costs associated with various components of the FEP and the NTP. These estimates are presented in Table 8. When funds are sourced domestically, the welfare cost is 6.65 percent for tradable goods and 2.2 percent for non-tradable goods. If funds are sourced abroad and spent on non-tradable goods, there is a welfare benefit at 4.45 percent instead of cost since it generates additional indirect taxes in the economy. For funds sourced abroad and spent on tradable goods, there is no impact on the economy, as pointed out earlier.

Kenya is an open economy and integrated into the world capital markets. When a project raises funds in capital markets to finance its expenditures on investment, part of the funds will be sourced domestically and the remainder from foreign savers. They are estimated at 79.59 percent from the local market and 20.41 percent from abroad, as presented in Section II. Thus, the FEP and the NTP for the base case are estimated to be 5.29 percent and 0.84 percent, respectively.

Table 10 Summary of Externalities for the Base Case (Percentage)

Funds from	Domestic Capital Source	Foreign Capital Source	Premiums
Funds Spent on Tradables	6.65	0.00	5.29
Funds Spent on Non-tradables	2.20	-4.45	0.84

3.3.6 Sensitivity Analysis for the FEP and the NTP

The above empirical results depend on the proportion of funds sourced from the domestic and foreign markets, the shares of tradable and non-tradable goods, the demand and supply elasticities of tradable goods, and others. A sensitivity analysis is performed to determine the impact of these key parameters on the estimates of the FEP and the NTP.

i. Alternative Sources of Funds

The proportions of funds sourced domestically and abroad are highly influenced by the elasticity of demand for domestic investment and the supply elasticity of foreign funds with respect to the market interest rates.

If the elasticity of demand for domestic investment is -0.5 instead of -1 assumed for the base case, the share of funds sourced from the domestic market becomes smaller to 71.82% from the base case, 79.59%. The remaining 28.18% will be sourced from foreign savings. Accordingly, The FEP and the NTP would be 4.77 percent and 0.33 percent, respectively.

On the other hand, if the elasticity of demand for domestic investment is -1.5 rather than -1, the share of funds from domestic sources increased to 84%, and from foreign funds, it will be reduced to 16% from the base case of 20.41%. The FEP and the NTP would be 5.58 percent and 1.14 percent, respectively.

With regard to the supply elasticity of foreign capital, if it is assumed at 2.50 rather than 2.0 assumed for the base case, the share of financing from foreign funds becomes larger to 24.27% from 20.41%. The remaining 75.73% will be sourced domestically. As a result, the FEP and the NTP would be 5.03 percent and 0.59 percent, respectively.

On the other hand, if the supply elasticity of foreign capital is 1.50 instead of 2.0, the share of financing from foreign savings will be reduced to 16.13%, and from domestic sources, it will increase to 83.87%. The FEP and the NTP would be 5.58 percent and 1.13 percent, respectively.

ii. The Shares of Tradable and Non-Tradable Goods

In the base case, we have assumed that the demand for importables accounts for 80% of the total tradable demand in the economy, while the supply of importables is 35% of the total supply of tradables. If the supply of importables in the total supply of tradables increases from 35% to 40%, and at the same time the demand for importables as a share of

total demand for tradables is assumed to be 70% instead of 80%, the results indicate that the FEP and the NTP would be 4.95% and 1.81%, respectively.

iii. Compensated Own Price Elasticity Demand for Imports

If the compensated own-price elasticity of demand for imports will become -1.80 rather than -1.52 for the base case. In this situation, the FEP would be 5.49%; for the NTP, the premium would be 0.30%. On the other hand, if the compensated own-price elasticity of demand for imports becomes -1.20, the FEP would be 5.08%; for the NTP, the premium would be 1.45%.

The results of the sensitivity analysis are summarized in Table 9. The value of the FEP ranges from 4.77% to 5.58% of the market value on tradable goods. For the NTP, it ranges from 0.30% to 1.81% of the market value on non-tradable goods. Hence, the average values of all extreme cases of the FEP and NTP are 5.21% and 0.96%, respectively.

Table 11 Results of Sensitivity Analysis for the FEP and NTP for Kenya

Scenarios	Key Assumptions	FEP	NTP
Base Case	- Sources of Funds: Domestic: 81.84%, Foreign: 18.16%., (With $\varepsilon_f = 2.0$ & $\eta = -1.0$) - Demand and supply of importables in total tradables: 80% and 35%. - Compensated Own Price Elasticity Demand for Imports: -1.515	5.29%	0.84%
Sensitivity Analysis:			
Sources of Funds ▪ Due to change in elasticity of demand for domestic investment (η is -0.5 & -1.5 in lower & upper bounds)	Domestic: 71.82%, Foreign: 28.18%	4.77%	0.33%
	Domestic: 84%, Foreign: 16%	5.58%	1.14%

▪ Due to change in supply elasticity of foreign savings (ε_f is 1.50 & 2.50 in lower & upper bounds)	Domestic 83.87%: Foreign: 16.13%	5.58%	1.13%
	Domestic: 75.73%, Foreign: 24.27%	5.03%	0.59%
Demand and supply of importables in total tradables	Demand: 70%, Supply: 40%	4.95%	1.81%
Compensated Own Price Elasticity Demand for Imports	-1.80	5.49%	0.30%
	-1.20	5.08%	1.45%

Although more cases could be simulated, we believe that a value of 5.2% for the FEP and 1.0% for the NTP would be the reasonable estimates for augmenting the financial values of tradable and non-tradable goods in the financial cash flow statement to the economic values in the economic resource statement while conducting the economic evaluation of investment projects in Kenya.

4. Concluding Remarks

This paper has described the analytical framework and the practical approach to the estimation of the economic opportunity cost of capital and the premiums on the foreign exchange and non-tradable outlays for Kenya. These national economic parameters are the key variables in estimating the net economic costs and benefits of investment projects.

The approach used to measure the economic opportunity cost of capital in this study is the weighted average approach. This approach considers the opportunity cost of raising funds in the capital markets for use in an investment project. Since the resources to be used in investment projects are limited, the rate of return to a proposed investment must be compared with the weighted average of the forgone returns that would have been generated by the ultimate sources of these funds. An increase in the demand for investable funds drives the market interest rate up. Consequently, some reproducible remunerative capital investment would be displaced, and the domestic and foreign savings would be stimulated.

Employing this method, we estimate that the real economic opportunity cost of capital would be approximately 11.36 percent in the base case.

Given the data obtained for the analysis and to ensure the robustness of the estimated values, we performed a sensitivity analysis by allowing the key parameters that have an impact on the measurement of the economic discount rate. The results suggest that estimates of the discount rate can range from 9.91 percent to 12.70 percent real. Consequently, we recommend that an 11.5 percent rate is an appropriate discount rate to use when calculating the economic net present value of the flows of economic benefits and costs over time.

The other national parameter is the foreign exchange premium, and the premium for non-tradable outplays. They are important for converting all financial cash flows into the economic resource statement in a consistent manner. This is due to the fact that various indirect tax and subsidy distortions are contemporarily affecting the financial value of tradable and non-tradable goods. Given the resource constraints, the analysis is undertaken in a general equilibrium in which resources must be shifted between tradable and non-tradable sectors in response to the relative price between these two sectors. The tax and other distortions must be measured in order to capture their impacts on the economy. The empirical results suggest that the economic value of the foreign exchange (FEP) exceeds the market exchange rate by 5.2 percent, and the shadow price of non-tradable goods and services (NTP) is just 1.0% higher than their financial values. These premiums need to be incorporated in the economic evaluation of investment projects.

The estimation of national parameters for Kenya has been a challenge with respect to data availability. In spite of this challenge, the methodology employed in this report is sound and the empirical simulations with various sensitivity analyses present robust estimates for the social discount rate and the premiums on the foreign exchange and non-tradable outlays to be used for economic appraisals of both public and private investment projects in Kenya.

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Appendix A. Return to Domestic Investment in Kenya 2006-2019 (Million Ksh)

	Current Prices (Million KSh)																		
Year	GDP	Compensation of employees	LIS (%GDP)	Total Labor Income	Taxes on Products	VAT	Subsidies on Products	GVA by AGR	GVA of Mining and quarrying	Resource Rents	Capital's share of Intermediation Cost	Economic Dep.Expense	Gross-of-tax Return to Capital	GDP Deflator Index (2009=1)	Real Return to Capital (2009 prices)	Reproducible Capital Stock	Remunerative capital stock	Real Value of Remunerative capital stock (2009 prices)	Real Rate of Return to Remunerative Capital
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**(19)**
2006	1,862,384	665,048	46%	856,697	91,571	79,926	421	350,737	10,028	351	2,105	255,710	509,956	0.72	708,853	5,095,264	3,719,543	5,170,268	13.71%
2007	2,151,615	752,482	45%	970,378	116,346	96,497	45	405,525	13,771	482	2,130	289,379	606,478	0.78	779,635	5,720,936	4,176,283	5,368,663	14.52%
2008	2,483,264	854,877	42%	1,030,554	126,594	111,905	72	510,355	16,786	588	3,002	295,607	820,697	0.90	916,201	6,795,266	4,960,544	5,537,805	16.54%
2009	2,863,795	925,268	42%	1,214,249	143,047	126,854	94	618,724	18,134	635	5,441	332,780	919,060	1.00	919,060	7,815,800	5,705,534	5,705,534	16.11%
2010	3,170,687	1,006,579	45%	1,420,468	158,372	148,353	107	730,394	26,029	911	6,397	364,763	917,873	1.02	899,047	8,308,541	6,065,235	5,940,834	15.13%
2011	3,727,416	1,123,816	43%	1,610,244	175,372	171,881	18,207	912,529	32,514	1,138	15,392	422,527	1,139,681	1.13	1,007,577	9,601,051	7,008,767	6,196,362	16.26%
2012	4,261,370	1,247,283	44%	1,866,480	182,245	176,386	32,027	1,028,364	46,628	1,632	18,245	475,466	1,321,976	1.24	1,068,514	10,991,953	8,024,126	6,485,662	16.48%
2013	4,745,090	1,452,179	45%	2,125,800	196,634	184,916	22,475	1,153,215	40,742	1,426	19,866	561,868	1,394,966	1.30	1,072,094	12,082,117	8,819,945	6,778,525	15.82%
2014	5,402,647	1,691,612	46%	2,463,607	253,037	232,630	30,584	1,372,197	44,936	1,573	22,595	730,422	1,400,248	1.41	995,810	13,779,501	10,059,036	7,153,652	13.92%
2015	6,284,185	1,881,911	44%	2,771,326	241,284	259,685	30,324	1,777,350	54,584	1,910	19,390	815,724	1,740,169	1.55	1,124,794	15,921,801	11,622,914	7,512,710	14.97%
2016	7,022,963	2,014,137	42%	2,942,622	267,027	289,213	29,970	2,055,465	59,149	2,070	22,310	861,022	2,132,951	1.63	1,306,171	17,382,012	12,688,869	7,770,376	16.81%
2017	8,165,842	2,371,295	44%	3,584,805	301,862	339,034	55,477	2,706,786	61,225	2,143	29,802	1,186,697	2,028,727	1.81	1,119,817	20,021,774	14,615,895	8,067,681	13.88%
2018	8,892,111	2,586,544	44%	3,908,325	311,890	356,856	60,279	2,873,516	67,648	2,368	29,765	1,318,020	2,225,217	1.86	1,199,222	21,244,516	15,508,497	8,357,897	14.35%
2019	9,740,360	2,830,810	44%	4,261,216	390,832	435,886	61,651	3,151,842	67,330	2,357	31,725	1,491,596	2,341,172	1.93	1,213,640	22,864,786	16,691,294	8,652,598	14.03%
																		Average	**15.18%**

Sources & Notes:

Columns (1), (2), (8), (9), (12) are obtained from the national accounts data, Kenya National Bureau of Statistics.
Column (3) is obtained from the ILO dataset.
Column (4) = (1) * (3)
Columns (5), (6), (7) are obtained from Statistical Abstract, Kenya National Bureau of Statistics, Nairobi
Column (10) = (9) * 3.5%
Column (11) is calculated as half of (6%*GFCF_private sector).
Column (13) = (1) – (4) – ((5)*(3)) – (6) + ((7)*(1-(3)) – ((8)*33%) – (10) – (11) – (12)
Column (14) is obtained from World Bank, national accounts data.
Column (15) = (13)/ (14)
Column (16) is obtained from appendix B.
Column (17) = (16) * 73%
Column (18) = (17) / (14)
Column (19) = (15) / (18)

Abbreviations: LIS: Labor Income Share; GVA: Gross Value Added; AGR: Agriculture.

Appendix B. Estimates of Total Capital Stock (2006 - 2019)

	Low Case	**Base Case**	High Case					
Annual depreciation rate for construction	2.00%	**2.50%**	3.00%					
Annual depreciation rate for machinery, transport equipment and other assets	4.00%	**6.00%**	8.00%					
Intial_Capital Stock (2006) (Current prices, Ksh Million)								
Capital stock of residential and non-residential structures	2,971,889.68							
Capital stock of machinery and (non-transport) equipment (computers, communication equipment and other machinery)	851,929.11							
Capital stock of transport equipment	1,115,292.07							
Capital stock of other assets (software, other intellectual property products, and cultivated assets)	156,153.19							
Total Initial Capital Stock (2006)	**5,095,264.05**							

	(Current prices, Ksh Million)									
Calendar Year	Investment in residential and non-residential structures	Investment in machinery and (non-transport) equipment	Investment in transport equipment	Investment in other assets	GDP Deflator (2009 =1)	Capital stock of residential and non-residential structures	Capital stock of machinery and (non-transport) equipment	Capital stock of transport equipment	Capital stock of other assets	Total capital stock
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2006	167,615	77,866	101,938	14,272	0.72	2,971,889.68	851,929.11	1,115,292.07	156,153.19	5,095,264.05
2007	201,188	108,419	103,113	16,791	0.78	3,334,363.02	974,340.25	1,236,723.44	175,508.81	5,720,935.52
2008	223,505	139,217	87,693	18,012	0.90	3,967,069.60	1,193,862.64	1,426,347.47	207,985.85	6,795,265.55
2009	265,662	144,785	100,042	19,434	1.00	4,583,663.01	1,397,610.58	1,596,834.37	237,691.69	7,815,799.65
2010	315,218	180,329	124,330	24,183	1.02	4,877,871.32	1,521,592.52	1,656,785.73	252,291.86	8,308,541.43
2011	378,422	207,307	141,881	31,479	1.13	5,647,559.99	1,791,948.25	1,867,317.16	294,225.18	9,601,050.58
2012	445,454	237,415	182,821	38,509	1.24	6,468,332.22	2,079,849.08	2,102,747.58	341,023.87	10,991,952.74
2013	502,717	253,618	182,503	38,678	1.30	7,135,323.46	2,309,730.83	2,261,252.98	375,809.52	12,082,116.78
2014	590,149	307,037	298,121	40,800	1.41	8,108,388.09	2,653,356.07	2,595,194.29	422,562.69	13,779,501.14
2015	682,801	325,055	302,856	47,655	1.55	9,380,992.22	3,069,238.75	2,986,887.04	484,682.53	15,921,800.53
2016	698,241	311,507	175,556	52,861	1.63	10,352,431.15	3,356,743.13	3,139,084.57	533,752.89	17,382,011.74
2017	863,454	353,280	219,477	56,673	1.81	12,061,514.04	3,853,874.83	3,493,085.62	613,299.26	20,021,773.74
2018	928,306	338,156	205,237	64,017	1.86	12,973,184.20	4,048,561.67	3,568,285.09	654,484.86	21,244,515.83
2019	992,218	338,706	230,530	70,418	1.93	14,142,104.76	4,295,098.69	3,717,580.09	710,002.72	22,864,786.26

Sources & Notes:

- Columns (1), (2), (3), (4) are obtained from the University of California, Davies, Penn World Table 10.0.
- Column (5) is obtained from World Bank, national accounts data.
- Initial capital stock (2006) for all categories is calculated as: [Investment (2006) / (Average annual growth rate + Annual depreciation rate)]. Average annual growth rate (2000-2005) = 3.14%
  For example, for initial Capital stock of residential and non-residential structures (2006) equals 2,971,889.68 = [167,615 / (3.14% + 2.5%)].
- Columns (6), (7), (8), (9) is estimated as follows:
  $K_{ti} = K_{ti-1} * (1 - \text{Annual depreciation rate}) * (1 + \Delta\text{GDP deflator}) + \text{Investment}_{ti}$
  For example, for Capital stock of residential and non-residential structures (2007) equals 3,334,363.02 = 2,971,889.68 * (1-2.5%) * (0.78/0.72) + 201,188
- Column (10) is the summation of Columns (6), (7), (8), and (9)

Appendix C. Return to Domestic Saving (Million KSh)

	Current Prices (Million KSh)				Constant Prices (Million KSh)			
Calendar Year	Gross-of-tax Return to Capital	Income Tax from corporations and other income tax	Property taxes	Return to Domestic Savings	GDP Deflator Index (2009=1)	Real Return to Domestic Savings	Remunerative capital stock	Rate of Return to Domestic Savings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2006	509,956	54,144	190	455,622	0.72	633,328	5,170,268	12.25%
2007	606,478	61,144	253	545,081	0.78	700,708	5,368,663	13.05%
2008	820,697	79,125	332	741,240	0.90	827,498	5,537,805	14.94%
2009	919,060	85,844	337	832,879	1.00	832,879	5,705,534	14.60%
2010	917,873	103,655	342	813,876	1.02	797,183	5,940,834	13.42%
2011	1,139,681	127,996	352	1,011,333	1.13	894,106	6,196,362	14.43%
2012	1,321,976	154,134	490	1,167,352	1.24	943,536	6,485,662	14.55%
2013	1,394,966	173,239	654	1,221,074	1.30	938,450	6,778,525	13.84%
2014	1,400,248	199,717	743	1,199,787	1.41	853,249	7,153,652	11.93%
2015	1,740,169	228,785	472	1,510,911	1.55	976,609	7,512,710	13.00%
2016	2,132,951	279,834	405	1,852,712	1.63	1,134,559	7,770,376	14.60%
2017	2,028,727	288,454	245	1,740,028	1.81	960,461	8,067,681	11.91%
2018	2,225,217	289,962	3,286	1,931,969	1.86	1,041,184	8,357,897	12.46%
2019	2,341,172	363,707	3,305	1,974,159	1.93	1,023,384	8,652,598	11.83%
							Average	**13.34%**

Sources & Notes:
Column (1) is obtained from column (13) in Appendix A.
Columns (2) and (3) are obtained from Statistical Abstract, Kenya National Bureau of Statistics, Nairobi.
Column (4) = (1) - (2) – (3)
Column (5) is obtained from World Bank, national accounts data.
Column (6) = (4) / (5).
Column (7) is obtained from column (18) in appendix A.
Column (8) = (6) / (7).

Appendix D. Share of Foreign Savings in Total Private-Sector Savings

	(Current prices, millions USD,)					(2009 prices, Millions KSh)			
Year	External Long-term Debt Stock	Foreign Direct Investment (FDI) Stock, Inward	Total Long-term debt and FDI Stock	Official exchange rate (LCU per US$, period average)	Total Long-term debt and FDI Stock (Current prices) (Millions KSh)	GDP Deflator Index (2009=1)	Total Long-term debt and FDI Stock	Total reproducible capital stock	Share of Foreign Investment to the total reproducible capital stock
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2006	5,893	1,164	7,057	72	508,492	0.72	706,818	7,082,559	9.98%
2007	6,254	2,272	8,526	67	573,807	0.78	737,636	7,354,333	10.03%
2008	6,410	2,760	9,170	69	634,555	0.90	708,399	7,586,034	9.34%
2009	6,741	4,251	10,992	77	848,987	1.00	848,987	7,815,800	10.86%
2010	6,998	5,449	12,447	79	985,406	1.02	965,195	8,138,129	11.86%
2011	7,764	6,899	14,663	89	1,302,096	1.13	1,151,167	8,488,167	13.56%
2012	9,004	8,279	17,283	84	1,459,903	1.24	1,179,996	8,884,468	13.28%
2013	9,908	9,398	19,306	86	1,662,433	1.30	1,277,655	9,285,650	13.76%
2014	13,587	10,219	23,806	88	2,093,667	1.41	1,488,946	9,799,523	15.19%
2015	15,874	10,839	26,713	98	2,622,982	1.55	1,695,419	10,291,384	16.47%
2016	17,824	11,518	29,341	102	2,979,155	1.63	1,824,367	10,644,351	17.14%
2017	22,494	12,784	35,278	103	3,648,158	1.81	2,013,710	11,051,618	18.22%
2018	27,263	14,410	41,673	101	4,220,362	1.86	2,274,453	11,449,175	19.87%
2019	30,886	15,742	46,628	102	4,756,404	1.93	2,465,672	11,852,874	20.80%
								Average	**14.31%**

Sources & Notes:

Column (1) is obtained from World Bank, International Debt Statistics.
Column (2) is obtained from UNCTADSTAT.
Column (3) = (1) + (2)
Column (4) is obtained from WB, World Bank Global Economic Monitor.
Column (5) = (3) * (4)
Column (6) is obtained from World Bank, National Accounts Data.
Column (7) = (5) / (6)
Column (8) is the real value of column (10) in Appendix B.
Column (9) = (7) / (8).

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Annexure B: Estimation of Commodity-Specific Conversion Factors Report

Estimation of National Parameters and Commodity Specific Conversion Factors (CSCFs)

Estimation of CSCFs for Tradable and Non-tradable Commodities

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Presented to: THE MINISTRY OF NATIONAL TREASURY AND PLANNING, KENYA

THE NATIONAL TREASURY AND PLANNING

Estimation of Commodity-Specific Conversion Factors for the Republic of Kenya

The Commodity-Specific Conversion Factors (CSCF) Database[55] has been developed for the Republic of Kenya. CSCFs are used to translate market prices for goods and services into corresponding economic value by accounting for various distortions that are present in the Kenyan economy such as taxes, subsidies, monopolies, etc. The database contains CSCFs for all tradable commodities (5,679), listed under the Harmonized System for classifying goods, and 14 non-tradable items (i.e., Administration, Communication, Construction, Education, Electricity, Extension services, Finance, Health, Hotels, Other services, Real estate, Trade, Transport, and Water).

The report is organized in three chapters. The first chapter briefly explains and presents the toolkit prepared for Kenya. Second section presents the methodology and estimation results for tradable commodities while the last section presents the same for non-tradable commodities and services.

1. CSCF Toolkit

Kenya CSCF Database is a web-based software that provides open access to the national parameters and CSCFs for tradable and non-tradable commodities and services. The program provides multiple ways to search and browse the database with an easy-to-learn interface. It is designed for professionals, policy makers, and academia involved in the economic and social appraisal of public investment projects in Kenya.

1.1. Website In-brief

Users will be met with a homepage every time they visit the website. All sections of the website can be accessed using the top navigation panel (i.e., tradable conversion factors, non-tradable conversion factors, national parameters and help).

For non-tradable conversion factors, users can estimate conversion factors for 14 non-tradables through a drop-down list. For tradable commodities, the website is equipped with a search engine that facilitates searching for the tradable commodities in the database. Users can search according to a keyword, HS Code, or (Sub)Chapter Number.

Website is also equipped with a feature that allow users to browse tradable commodities by categories. The Browse Categories page provides an alternative way to search through tradable commodities, categorized into 99 HS chapters. When a user selects a chapter, the chapter will expand and reveal all sub-chapters associated with the chapter. Once the sub-chapter is also selected, it will expand to show all commodities within the sub-chapter. For each commodity

[55] The database is accessible through http://kenya.cri-world.com .

selected, four different types can be selected to reveal different estimations, which are “Importable Input”, “Importable Output”, “Exportable Input” and “Exportable Output”.

Users are allowed to automatically save their estimation results to an excel file. Users can add various commodities (tradable or non-tradable) or different types of a particular tradable commodity to the download list each time CSCF is displayed for the commodity. Once the desired numbers of items are added to the list, the list can be downloaded for their future reference.

The website is designed in a manner that allow users to update key inputs of each tradable commodity or non-tradable service to the website temporarily. For instance, the estimates of CSCFs for tradable goods can be easily updated if either the custom duty rates, value-added taxes, environmental tax, or FEP changes. Temporary changes of the inputs only affect each specific user and will automatically reverts to its default value as the user surfs through the website. Maintenance of the website and permanent update of the key inputs is only restricted to the users with administrative access to the website through administrator login credentials and will change the results for all different users permanently.

Here below you may find snapshots of the toolkit.

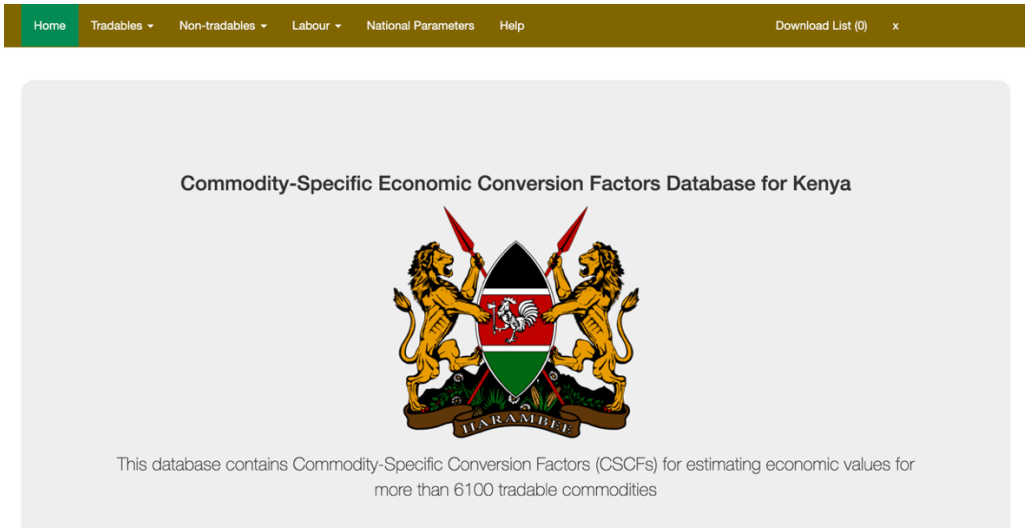

Figure 3: Homepage

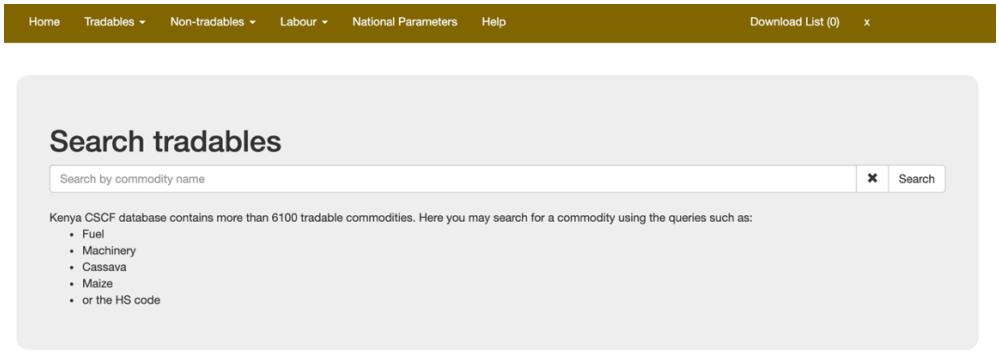

Figure 4: Searching Tradable Commodities

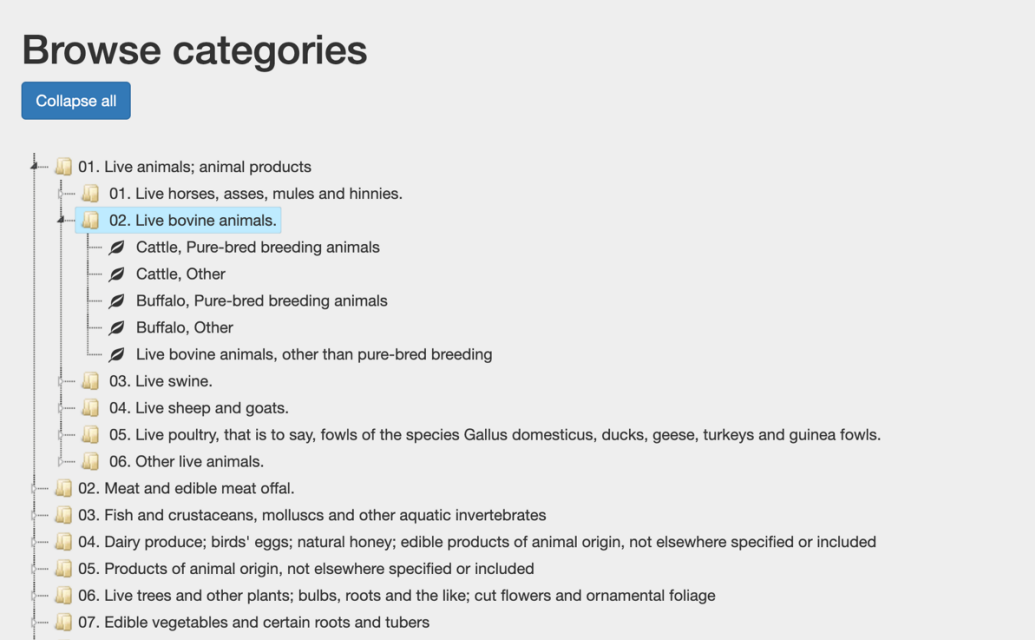

Figure 5: Browsing Tradables by Category

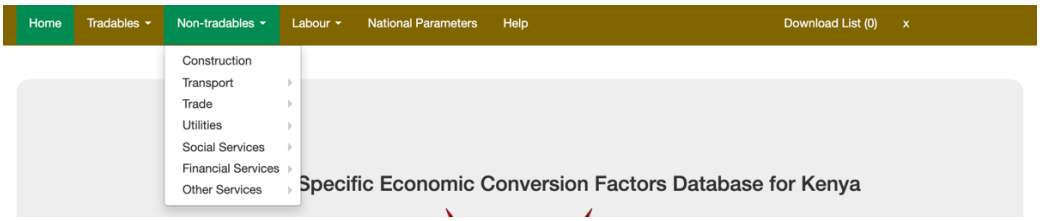

Figure 6: Non-tradable drop-down list

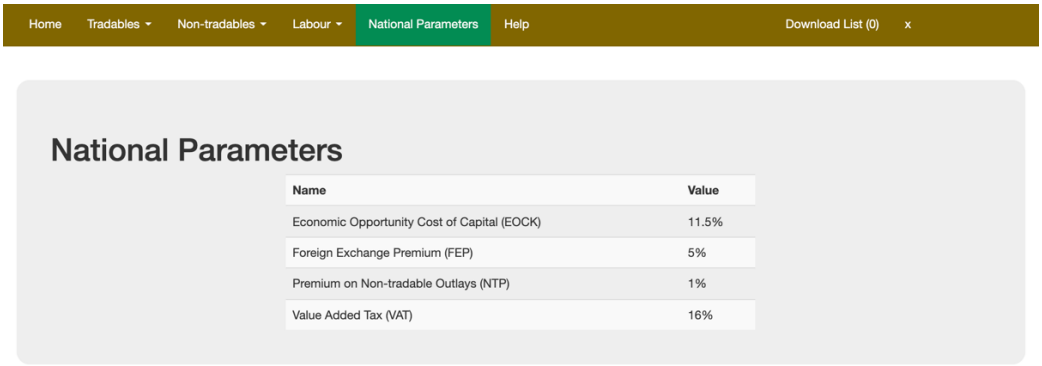

Figure 7: National Parameters for Kenya

2. Conversion Factors for Tradables

2.1. Methodology

A good or service is considered tradable when an increase in demand (supply) by a project does not affect the amount demanded (supplied) by domestic consumers (producers). The increase in demand (supply) by a project is eventually reflected as an increase (decrease) in imports or a

decrease (increase) in exports depending on whether the project is demanding or supplying the importable or exportable commodity.

Kenya importable goods include (a) all goods imported into Kenya and (b) all goods produced and sold domestically that are close substitutes for either the imported goods or potentially imported goods. Kenya exportable goods, on the other hand, include (a) all goods exported by Kenya and (b) domestic consumption of similar or close substitutes for the exported goods.

The first step in estimating CSCFs for tradable commodities is to determine the applicable tax rates for each commodity using the latest Harmonized Commodity Description and Coding System. Next, the corresponding distortions are identified and applied. These distortions include import tariffs, export taxes, subsidies, value added tax (VAT), other indirect taxes and non-tariff barriers such as quotas. The distortions will have a considerable influence on the financial prices of the goods in the market. From the economic point of view, however, it is the world price that reflects the value of the good. Taxes are resource transfers from consumers to the Kenyan Government. Lastly, depending on whether the commodity is an input for or the output of the project, the CSCF is calculated according to the following formulae.[56]

Importable inputs/outputs:

$$CSCF_{II\ \&\ IO} = \frac{1 + FEP}{1 + T_m - K_m + (T_e + T_o) \times (1 + T_m - K_m) + IDF + RDL + VAT \times (1 + T_m - K_m + T_e(1 + T_m - K_m) + T_o(1 + T_m - K_m))}$$

Where,

- FEP is the foreign exchange premium.
- T_m stands for the rate of import duty levied on the CIF price of the imported input
- K_m is the rate of import subsidy expressed as the percentage of the CIF price
- T_e is the rate of excise duty levied on the CIF price plus the import duty on the imported input (retail price excluding VAT)
- T_o is the rate of Road Maintenance Levy (RML), Petroleum Regulation Levy (PRL), and Petroleum Development Levy (PDL). This applies on the CIF price plus the import duty/subsidy on the imported input (retail price excluding VAT).
- IDF is Import Declaration Fee
- RDL is Railway Development Levy
- VAT is the value added tax rate levied on the basis of the sum of CIF price plus import duty, excise duty, RML, PRL, and PDL.

Exportable inputs/outputs:

$$CSCF_{EI} = \frac{1 + FEP}{1 + K_x - T_x + VAT(1 + K_x - T_x)} \qquad CSCF_{EO} = \frac{1 + FEP}{(1 + K_x - T_x)}$$

Where,

- FEP is the foreign exchange premium
- K_x stands for the rate of export subsidy, (expressed as the percentage of the FOB price)
- T_x is the rate of export tax, (expressed as the percentage of the FOB price)

[56] More detailed theoretical aspects of the economic prices of tradable commodities can be accessed from Jenkins et al. (2011), DDP 2011-10, John Deutsch International, Queen's University, Canada. URL: http://ideas.repec.org/p/qed/dpaper/203.html

2.2. Estimation results

The CSCF estimation for all the tradable commodities in the database ranges from 0.0057 for "Cigars, cheroots and cigarillos, containing tobacco", on which high import duties and excise duties are levied, to 5.2500 for "Raw hides and skins (other than fur skins) and leather" as exportable outputs. The estimates are available at http://kenya.cri-world.com.

2.3. Examples

The web-based application allows analysts to easily locate a particular good, either using HS code or the name of the commodity. In a situation where software is not available, an analyst will need to perform a stand-alone calculation for each tradable input to the project, as seen on the upper section of Figures 6-9 below. CSCFs estimates, therefore, greatly save time that would otherwise be spent to complete economic appraisal of an investment project as the estimates are readily available for an analyst. This is reflected on the bottom side of Figures 6-9. Moreover, it also greatly improves the consistency of project appraisal across all Ministries, Departments and Agencies (MDA)s as major inputs required to transit from financial into economic appraisal is now standardized. It should be noted that the toolkit provides great flexibility, allowing the analyst to easily update any of the parameters used for calculation, i.e., import duties.

Importable Input:

Air conditioning machines (HS code 8415.10.00) are mainly being imported to Kenya. As input for construction projects, "Air conditions" can be assumed as an importable input; the conversion factor is equal to 0.6977. Distortions taken into account for this conversion factor are Value Added Tax (16%), Import Duty (25%), Import Declaration Fee (3.5%), Railway Development Levy (2.0%), and Foreign Exchange Premium (5.0%).

	Air Conditioning Machines - Importable Input	%	Financial Value - FV	FEP	Value of FEP	Economic Value - EV
	CIF Price of Air Conditioning Machines		1.000	5.00%	0.050	1.050
[+]	Import Duty (% of CIF Price)	25.0%	0.250			
[+]	IDF (% of CIF)	3.5%	0.035			
[+]	RDL (% of CIF)	2.0%	0.020			
[+]	VAT(% of CIF and Import Duty)	16%	0.200			
	Price at Port		1.505			1.050
	Conversion Factor - Air Condition	**0.6977**	*CF*			

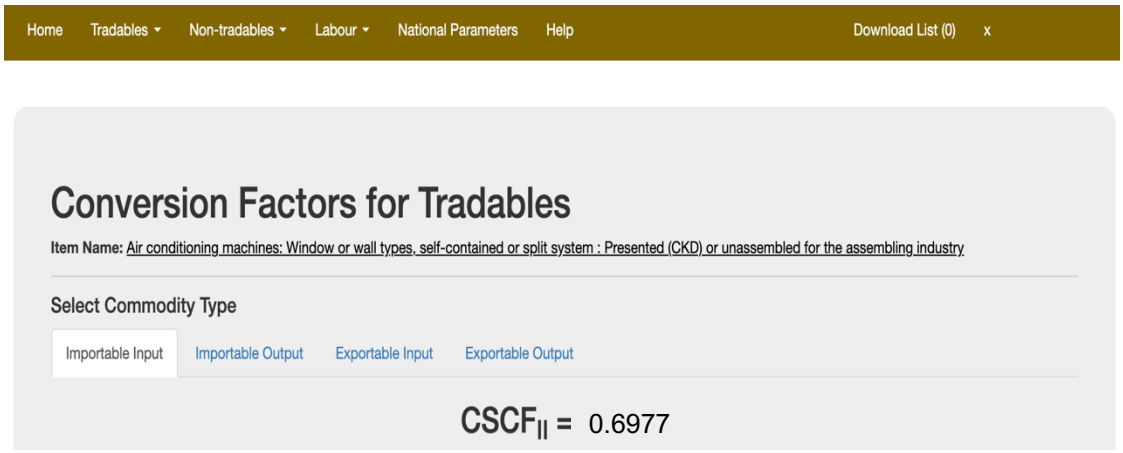

Figure 8: Importable Input

Importable Output:

Petroleum Jelly (HS Code 2712.10.00) is an output of a chemical factory. Assuming that Kenya is mainly importing petroleum jelly, this product is considered as an importable output for this factory. Conversion Factor is equal to 0.6656 considering 16% VAT, 25% import duty, 5% excise duty, 3.5% import declaration fee, 2.0% railway development levy, and 5.0% FEP.

	Petroleum Jelly - Importable Output	%	Financial Value - FV	FEP	Value of FEP	Economic Value - EV
	CIF Price of Petroleum Jelly		1.000	5.00%	0.050	1.050
[+]	Import Duty (% of CIF Price)	25.0%	0.250			
[+]	Excise Duty (% of CIF Price and Import Duty	5.0%	0.063			
[+]	VAT(% of CIF Plus Import and Excise Duty)	16%	0.210			
[+]	IDF (% of CIF)	3.5%	0.035			
[+]	RDL (% of CIF)	2.0%	0.020			
	Price at Port		1.578			1.050
	Conversion Factor - Petroleum Jelly	**0.6656**	*CF*			

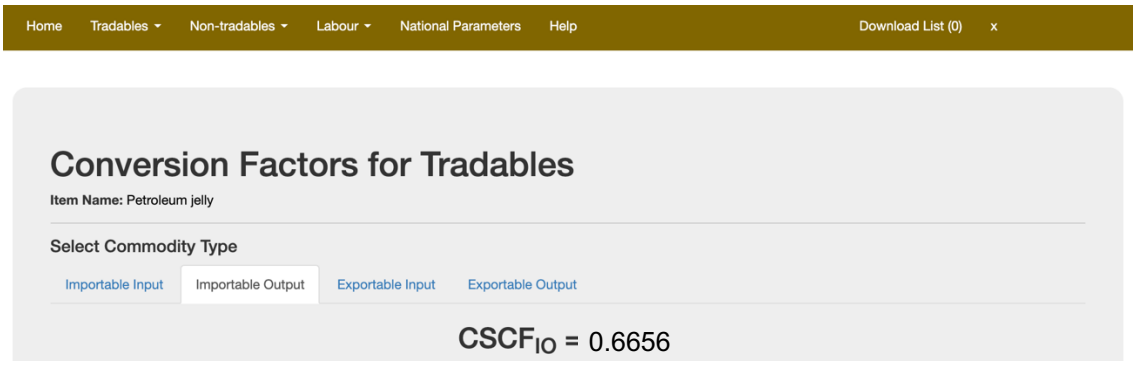

Figure 9: Importable Output

Exportable Input:

Interchangeable Tools can be a good example of an Exportable Input for a construction work in Kenya. Interchangeable tools are being used in construction works as an input, and at the same

time, Kenya is mainly exporting such tools to other neighbouring countries. HS Code to be used is 8207.90.00, and the conversion factor is 0.9052 when being considered as an "Exportable Input". Distortions considered in the estimation of this conversion factor are 5.0% Foreign Exchange Premium, and 16% Value added Tax (VAT).

	Interchangeable Tools - Exportable Input	%	Financial Value - FV	FEP	Value of FEP	Economic Value - EV
	FOB Price of Interchangeable Tools		1.000	5.00%	0.050	1.050
[+]	VAT(% of FOB)	16%	0.160			
	Price at Port		1.160			1.050
	Conversion Factor - Interchangeable Tools	**0.9052**	*CF*			

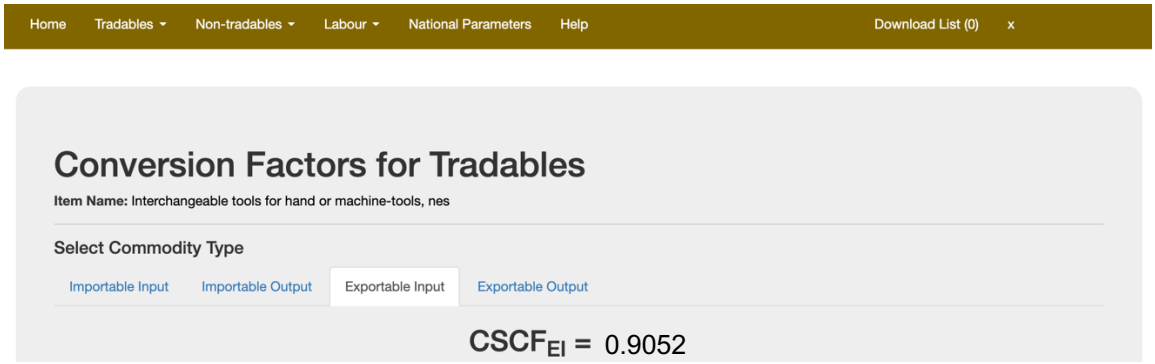

Figure 10: Exportable Input

Exportable Output:

Pineapple Juice (HS Code 2009.41.00) is an output of a juice factory, and assuming that Kenya is mainly exporting pineapple juice, this product is considered as an exportable output in the case of a juice factory. The only distortion is the Foreign Exchange Premium (FEP) of 5.0%. Therefore, the Conversion Factor is equal to 1.05.

	Pineapple Juice - Exportable Output	%	Financial Value - FV	FEP	Value of FEP	Economic Value - EV
	FOB Price of Pineapple Juice		1.000	5.00%	0.050	1.050
	Price at Port		1.000			1.050
	Conversion Factor - Pineapple Juice	**1.0500**	*CF*			

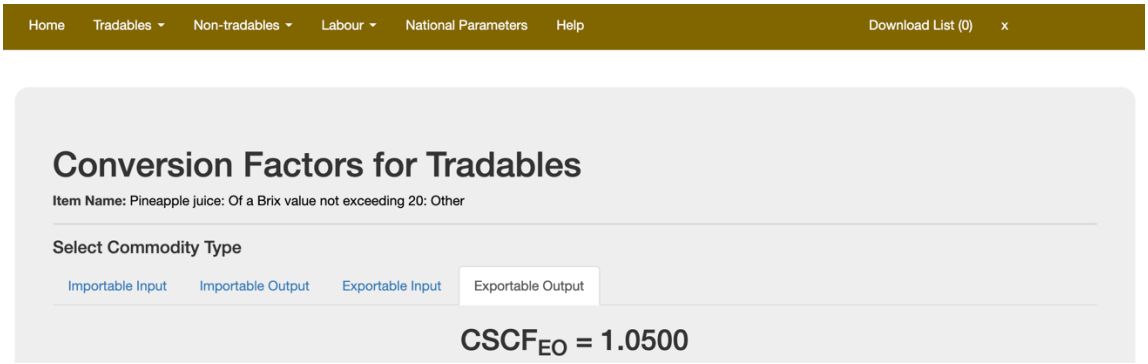

Figure 11: Exportable Output

3. Conversion Factors for Non-tradables

The number of non-tradable goods and services in any economy is typically much smaller than that of tradable commodities. The database contains CSCFs for 14 non-tradable commodities. In contrast to tradable goods, the non-tradable services are only used as inputs into projects. In a situation when non-tradable service is an output of a project, i.e., roads, the value of this output is determined on a project-by-project basis.

3.1. Methodology

A good or service is considered non-tradable when its domestic price is determined by local demand and supply. An increase in demand (or supply) by a project could affect the amounts demanded by domestic consumers (or produced by other suppliers).

Conversion factors for non-tradable commodities is estimated by eliminating the distortions such as taxes, subsidies, trade taxes, licenses and quotas, monopoly mark-ups, environmental externalities, congestion costs, and any other type of price or quantity restriction that causes the demand price of the item to diverge from its supply price. A difference may exist between financial and economic prices, even in the absence of distortions.

In the case of the market for non-tradable commodities, increased demand for an input to be used by the project or increased supply of an output produced by the project would impact the market equilibrium price. This change will cause the other consumers and producers in the market to adjust their quantities consumed and produced, respectively. Additionally, in the presence of market distortions, other impacts are included in economic analysis.

To estimate the economic prices of non-tradable goods and services we first adjust for distortions in the market for the item itself. Second, we adjust for distortions in the market where demand is being diverted towards or away from. Third, distortions in the markets for the inputs used to produce the item are corrected. Correction is applied to the proportion of the item produced by other suppliers in the market. Finally, we apply a correction for the FEP and SPNTO on tradable and non-tradable components of the non-tradable good or service. This is done according to the following formula:[57]

$$P_x^e = W_x^s P_x^m (1 + K_x) + W_x^d P_x^m (1 + t_x^v - d^*)$$

$$-W_x^s \left[\sum_i a_{ix}^o P_i^m d_i + \sum_j a_{jx}^o P_j^m d^{*\,two} + \sum_L a_{Lx}^o P_L^m d_L + \sum_z a_{zx}^o \{W_z^d P_z^m (d^* - t_z^v)\} \right]$$

$$+[P_x^m \times T_x \times FEP] + [P_x^m \times NT_x \times NTP]$$

$$CSCF = \frac{P_x^e}{P_x^m \times (1 + t_x^v)}$$

[57] Further theoretical details of the estimation of the economic prices of non-tradable goods and services can be found in Jenkins et al. (2011), DDP 2011-11, John Deutsch International, Queen's University, Canada. URL: http://ideas.repec.org/p/qed/dpaper/204.html

where,

- x : Non-tradable output produced or purchased by the project
- P_x^e : Economic price of output x
- W_x^s : Supply weight for output x
- W_x^d : Demand weight for output x $(W_x^d + W_x^s = 1)$
- P_x^m : Market price per unit of output x (net of value added tax, i.e., VAT)
- k_x : The rate of production subsidy on output x
- t_x^v : VAT on output x
- d^* : The overall effective tax rate on tradable and non-tradable goods and services in the economy
- a_{ix}^o : Input-output coefficient for tradable input i used in the production of a unit of output x
- P_i^m : Market price per unit of input i (net of VAT)
- d_i : The rate of non-creditable tax or subsidy on the tradable inputs used in the production of output x
- a_{jx}^o : Input-output coefficient for tradable input j used in the production of non-tradable inputs (direct tradable inputs to the NT inputs and the indirect tradable inputs of their subsequent inputs) used for a production of a unit of output x
- P_j^m : Market price per unit of j
- $d^{*\,two}$: The overall average effective tax rate of the tradable inputs (in the whole economy) used indirectly in the non-tradable inputs for a production of output x excluding VAT.
- a_{Lx}^o : Input-output coefficient for direct and indirect labor input L used in the production of a unit of output x
- P_L^m : Market price per unit of labor L
- d_L : The rate of distortions on the labor inputs used in the production of output x
- a_{zx}^o : Input-output coefficient for non-tradable input z (direct input) used in the production of a unit of output x
- W_z^d : Demand weight for input z
- P_z^m : Market price per unit of input z (net of VAT and distortions on tradable components of input z)
- t_z^v : VAT on input z paid by the new consumers of z
- T_x :Share of tradable components for output x
- NT_x : Share of non-tradable (i.e., Labor) components of output x $(T_x + NT_x = 1)$
- FEP: Foreign exchange premium
- NTP: Premium on non-tradable outlays

3.2. Estimation Results

The CSCF estimation for the non-tradables range from 0.7878 for "Extension services" and "Education" to 0.9015 for "Real estate". The estimates are available at http://kenya.cri-world.com

Table 12: Commodity Specific Conversion Factors for Non-Traded Goods

Item	CSCF
Administration	0.8140
Communication	0.8295
Construction	0.8558
Education	0.7878
Electricity	0.8596
Extension Services	0.7878
Finance	0.8433
Health	0.7890
Hotels	0.8003
Other Services	0.8161
Real Estate	0.9015
Trade	0.8578
Transport	0.8780
Water	0.8577

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Annexure C: Economic Opportunity Cost of Labor

Estimation of The Economic Opportunity Cost of Labor: An Operational Guide for Kenya

1. Introduction

The need to measure the social or economic opportunity cost of resources arises whenever such resources are diverted from current uses (or non-use) to a government project. The economic acceptability of any proposed project depends upon the cost and benefit streams expected over the lifespan of the project, and a vital aspect of any cost-benefit analysis is how to determine the proper values to the resources required as inputs.

For the specific case of the labor input, when workers are hired by a project, they are giving up one set of market and non-markets activities for an alternative set. The economic opportunity cost of labor is the value to the economy of the set of activities given up by the workers, including the non-market costs (or benefits) associated with the change in employment. Jenkins (1995)

Employment is often a hot topic when it comes to any government in the world, as it is a primary macroeconomic objective. For years, governments in many countries have actively promoted creating employment for people to mitigate their relatively high unemployment rates. For any project to be economically justified, the net present value of the net economic benefits of the project must be positive. One of the most important benefits is the labor externality (LE) from the jobs created by a project, which can be estimated by the difference between the wage paid on the project and the economic opportunity cost of labor.

$$LE = Wp - EOCL \quad (1)$$

When this value is positive, it implies that the financial cost of labor will be greater than its economic cost. The LE can split between the worker and the government. The magnitude of LE is related to several factors, including the supply conditions of the type of labor being employed. This analysis, however, will illustrate that additional elements such as social security programs, income taxes, and union monopoly power also need to be considered.

The purpose of this study is to show how economic theory can be empirically applied to estimate the economic opportunity cost of labor for public projects in the Kenyan economy. Given that labor is a highly heterogeneous production factor, estimating the EOCL would not be an easy task. Typically, the labor market experiences different dynamics across occupations, skills, working environments, labor market conditions, and regions. Thus, the EOCL will also vary across these situations.

The variability of the EOCL necessitates the need to develop an operational estimation methodology that quantifies this opportunity cost across occupational groups and different labor markets with an acceptable degree of accuracy. In this vein, the current work provides an operational guide to estimating the EOCL for various skills and labor market types applicable to Kenya.

The study is organized as follows; after this introduction, the second section gives an overview of the Kenya labor market and some of its essential aspects. Section 3 describes the methodologies applied in this guide and discusses its associated advantages. Section 4 considers eight cases involving seven cases dealing with domestically sourced labor relevant to Kenya, while the last case considers foreign labor employment. Finally, concluding remarks are presented in the fifth section. An Excel model is accompanied to this study to allow the project analyst to estimate the value of EOCL for the specific type of labor employed.

2. Labor Markets in Kenya

Kenya is ranked as a lower-middle-income country and has become the third-largest economy in sub-Saharan Africa with well-organized industrial relations. The economic growth has been robust, along with increasing wages; however, structural challenges affect the labor market. Kenya's economy is characterized by a formal sector experiencing an environment of shrinking employment opportunities and an informal sector that is increasingly expanding and absorbing entrants from schools and training institutions to the labor market. The failure of the formal sector to generate sufficient wage employment to accommodate all entrants to the labor force has led to

many youths starting their businesses or seeking employment in the informal sector. (Kenya National Bureau of Statistics, 2020b)[58].

The employment structure has changed over time with the informal sector expanding into manufacturing, transport and information, communication, and technology and taking a leading role in job creation. In 2019 the informal sector was estimated to have created 767.9 thousand new jobs, constituting 90.7 percent of the total new jobs created outside of small-scale agriculture. The informal sector's contribution to total employment has increased from 10.4 percent in 1972 to 46.9 percent and 83 percent in 1992 and 2019, respectively,[59] which is shaded by non-compliance with labor regulations (including wages).

Bigsten and Wambugu (2010) argue that the increase in informal sector firms leading to the employment expansion in the sector is mainly made possible by the limited capital requirements for new jobs in the sector. The formal sector employment expansion, on the other hand, has been constrained by the inability of the country to achieve rapid capital accumulation to improve on the capital-labor ratio and the labor market regulations that have tended to increase labor costs relative to productivity in the sector.

Kenya's employment composition by sector has been relatively stable during the last decade and a half. The agricultural sector contribution of total employment is estimated to decrease six percentage points from 61% in 2005 to 55% in 2019. It remains by far the most significant sector measured by numbers of employed.[60] However, fluctuations in employment demand reflect on the weather effects with significant dips experienced during severe droughts. In the period from 2005 to 2019, the service sector has increased seven percentage points to 39%. The industry sector has remained its size at 6% share.

Like in most countries, especially Sub-Saharan Africa, the labor market in Kenya experiences an internal rural-urban migration. Rural areas accounted for two-thirds of the total jobs in the informal sector, which means that labor supply is high in rural areas.[61] The country has

58 See Informal Sectors Skills and Occupations Survey (ISSOS), 2020.

59 See Economic Survey 2020.

60 Source: International Labour Organization, ILOSTAT database. Data retrieved on January 29, 2021.

61 See Economic Survey 2020. Table 3.11, Persons engaged in the informal sector by activity.

recorded a steady rise in urbanization. In 1950, the share of the urban (rural) population was 7.36 percent (92.64 percent). In 2019, the urban population increased to 27.99 percent, while the rural population has declined to 72.01 percent of the total population due to rural-urban migration resulting from the pull factors in urban areas (quality of life and economic opportunities in urban areas, among others).

The higher minimum wages in urban areas have been identified as one of the contributing factors to rural-urban migration in developing countries. Migration of labor can also partly be attributed to insufficient support extended to agricultural production and low prices for farm produce. The labor movement is explained by the availability of greater opportunities in urban areas with the most educated workers migrating in search of jobs. (M Wangi et al., 2017).

According to Agesa (2001), in Kenya, the gap between expected urban and rural wages and higher levels of education encourages rural-to-urban migration as the returns for higher productivity are greater in cities. Agesa and Agesa (2005) investigate the factors that influence Kenyan rural-urban migration. They found that the wage gap between migrants in urban areas and non-migrants in rural areas greatly increased the likelihood of males migrating from rural to urban locations.

It has also been common over past years in Kenya for certain groups of workers to relocate abroad with the hope of improving their fortunes. Kenyan emigrants to the United Kingdom, United States of America, Canada, and South Africa being skilled and educated and leave for employment or education abroad through traditional means (UNDESA, 2019). Increasingly, low-skilled Kenyan migrant workers migrate to the Middle East and the Gulf countries for work, as job opportunities are generally more than in other regions.

Despite a large and growing supply of labor in general, foreign workers are brought in by corporations or the government for projects requiring their skills. In Kenya, this often takes the form of high skilled labor or technical staff. According to Song (2016), the estimated number of Chinese migrants living and working in Kenya is between 80,000 and 100,000; they are also well-educated and are typically employed by construction companies.

In light of the foregoing, this study focuses on a number of scenarios that demonstrate how the EOCL should be calculated in each of these situations. Now we turn to a discussion of the methodology.

3. Methodology

The challenge of measuring the economic opportunity cost of labor is a subject of considerable discussion in the economic literature, which can be summarized into two alternative methods: foregone product and supply price. The fundamental consideration in the foregone product approach is to take the current technology and market structure as given and try to determine the value of the marginal product foregone when a worker is added to the public payroll.[62] The second approach is via the supply price of labor which is defined by Harberger (1972) as the amount for which a worker is willing to present himself for work at a specific project site.

The supply price is an ideal measure in the sense that it is location-specific and implicitly includes the value of a foregone product as well as the value of all other monetary and non-monetary sacrifices that the worker makes when he presents himself at the project site. The easiest way to think of the economic opportunity cost of labor in a given area, occupation, industry, or other category is to start with the market wage and make a series of adjustments. All the labor of each type earns its relevant market wage. (Harberger, 1985). This analysis employs the latter approach as it is generally more straightforward and applicable across varying labor market conditions and has less stringent data requirements.

When employing the supply price approach, we first consider the gross tax wage that employers need to pay in order to obtain sufficient workers of a particular skill. This variable is also generally well-known amongst employers operating in the region of the project. It is the net of tax wage; however, that potential employees are responding to when choosing to work on the project or not. An advantage of this approach is that the net of tax supply price already captures the worker's preferences for location, working conditions, and other idiosyncratic factors which may affect their decision to work on the project. From the individual's perspective, this price reflects the economic cost of supplying labor to the project.

62 This approach has been initially proposed by Little and Mirrlees (1968).

The marginal product foregone approach would require the project analyst to estimate the monetary values of each of the components individually and accordingly adjust the foregone wages for the equalizing differences in well-being and costs as valued by the worker between the employment and living conditions of the alternative employment situations facing the potential project employee. This generally cannot be done with an acceptable degree of accuracy, given the time constraints associated with the appraisal of the project.

If a project hires labor, we should expect some people already employed in other places to move to the project. These workers will migrate to the project if their project wage is at least as large as their required supply price. This labor market adjustment will decrease the quantity supply of labor supplied in the alternative labor markets. It is important to note that if a labor market is characterized by a high level of unemployment, this fact will tend to lower the supply price (gross of tax wage) that the workers would require before offering their labor services to the project. The opposite is also the case when a particular labor type is in short supply. Here we would expect to find that the supply price of this type of labor will rise.

Once the gross of tax supply price (wage) for the project is determined, it is adjusted to account for the various distortions present in the labor market. It is critical to incorporate all the relevant distortions to estimate the EOCL accurately.

These distortions arise from the presence of income taxes, social security contributions, employment insurance, labor union monopoly power, enforced minimum wage laws, or any other type of tax or subsidy present in the project's labor markets. Furthermore, when workers move from an alternative job to work on the project, they will consider the net of tax wage they are giving up and the minimum net of tax wage they must receive to be willing to work for the project. If they pay taxes on the wages they earn in their alternative employment, they will not consider these taxes lost as a loss in economic welfare.

While the reduction in tax revenues from the reduction in employment is not in itself an economic welfare loss, however, the worker must have been generating a value of a product in the alternative employment large enough, so the employer is willing to pay a gross of tax wage sufficient for the employee to earn his/her supply price for that job and at the same time be able to pay the tax on these wages. This component of the value of the marginal product of labor that serves to cover

the cost of these taxes is an economic loss that the worker does not consider when moving to the project from alternative employment. Hence, two adjustments need to be made to the gross of tax supply price associated with the project. First, a subtraction must be made of the tax component of this supply price for the project site and an addition to an amount that is measured by the taxes no longer paid where a worker moves from the alternative place of employment.

When a project hires additional employees, it is natural that some new workers may represent new entrants to the formal labor force in response to the improved labor conditions created by the project. These new entrants will be responding to the opportunity to earn a net of tax wage that will be paid by the project. If there are no taxes or subsidies associated with their prior non-formal market activities, then the gross of tax wage rate reflecting the supply price to the new project only needs to be adjusted by the taxes that will be paid by the new labor force entrant earning this supply price-wage. In the absence of taxation, worker migration for employment on a new project from employment in an alternative market requires no adjustment to drive the EOCL. The supply price captures exactly the lost benefits of the worker in the alternative market.

In summary, when labor markets are competitive, the estimation of the EOCL begins with the gross of income tax supply price of labor; W_g^s for a particular type of labor skill that will be supplied to a specific project at a given location. This wage, $W_g^{s,}$ reflects the minimum wage that the project would need to offer in order to meet its labor needs. This simple measure captures a number of important factors. For instance, this wage already accounts for the worker's skill level, its preferences regarding location, working conditions, the disutility of moving to the project, time spent away from family or household production, and the alternative employment opportunities available to the person. In a market with no distortions, this supply price wage for a type of labor captures the EOCL as it captures all of these foregone opportunities for the worker. This is, in essence, the advantage of the supply price approach to estimating the EOCL of labor.

3.1 Methodology for Estimation of the EOCL in the presence of taxes and other distortions.

When distortions are present in the labor market, we must adjust the supply price to account for these. The two most common distortions in the labor market are income and social security taxes. Income tax is levied on the growth of income wage received by the employee. Typically, the

responsibility for the payment of income tax is on the individual employee. However, the employer might be required to withhold the estimated income tax at the time wages are paid. The tax base for social security tax is also the wage gross of income tax paid by the employer to the employee. However, the amount of this tax is calculated by the employer and paid to the government. From the perspective of the employer, the total employee compensation or payment is the project wage (W_p) plus the social security paid by the employer (T_s). These two added together to become the total employee compensation $W_p' = W_p(1 + T_s)$.

When the wages are subject to income taxes, the EOCL becomes the gross-of-tax supply price to the project less the income taxes paid by this worker on the project plus any tax lost as a consequence of the movement of labor to the project. We can denote the share of the project's labor sourced from currently employed workers as H^d. These workers earn the alternative wage W_g^a. The remainder of the project's labor would be sourced from the informal sector or non-market activities, which does not require adjusting for income taxes [63]. In what follows, the degree of distortions in the market is the most relevant factor.[64] In the case of the presence of distortions, the EOCL is:

$$EOCL = W_g^s - (W_g^s\, T - H^d\, W_g^a\, T') \quad (2)$$

where:

- W_g^s denotes the gross of income tax supply price of labor.
- W_g^a denotes the gross of income tax wage of labor from alternative sources.
- T denotes the income tax rate plus social security paid by employees corresponding to the supply price of labor.
- T' denotes the total effective tax rate, including both the income tax rate and the social security taxes ($T_s + T_{s1}$) corresponding to the alternative wage rate.
- T'' denotes the income tax rate plus social security paid by employees corresponding to the project wage, levying on wages in the formal sector.

63 The tax structure applicable to labor income in Kenya is detailed in the Appendix.

64 Jenkins, Glenn P., and Arnold C. Harberger. Cost-Benefit Analysis of Investment Decisions,2019.

- H^d denotes the proportion of the project's demand for labor obtained from taxed employment in the alternative market.

In equation (2), the supply price of labor is adjusted (reduced) by the income tax rate levied on the wage paid to the project's labor force ($W_g^s\ T$) and is increased by the income and social security taxes lost from reduced employment in the alternative formal labor market ($H^d\ W_g^a T'$). In the case of Kenya, H^d is a particularly important parameter. Because the informal sector makes up such a large portion of economic activity, it may be reasonable to assume that a great deal of labor comes from informal market activities as opposed to alternative formal markets. As such, we would expect a reasonable parameterization of Hd for Kenya to be lower than for a county where the informal sector is less substantial.

From equation (2), we can calculate the labor externality associated with a project when distortions are present. We present the general case here and illustrate the calculation of this externality alongside the estimation of the EOCL below. Again, from equation (1), the labor externality is:

$$
\begin{aligned}
LE &= W_p' - EOCL \\
&= W_p' - [W_g^s + (W_g^s T - H^d W_g^a T')] \\
&= W_p (1+T_s) - [W_g^s + (W_g^s T - H^d W_g^a T')] \\
&= W_p + W_p{*}T_s - W_g^s - W_g^s T + H^d W_g^a T' \\
&= W_p T'' + W_p (1-T)'' + W_p{*}T_s - [W_g^s (1-T) + H^d W_g^a T'] \qquad (3)
\end{aligned}
$$

We can interpret each of the terms above as being benefits accruing to labor or taxes gained (+) or lost (-) by the government:

$$\text{Labor benefits} = W_p\ (1-T'') - W_g^s\ (1-T) \qquad (4)$$

$$\text{Government benefits} = W_p\ T'' + W_p{*}T_s - H^d\ W_g^a\ T \qquad (5)$$

4. Economic Opportunity Cost of Labor

This study will now apply the supply price of labor approach to estimate the EOCL used by projects for different situations relevant to Kenya. Firstly, we will evaluate the EOCL on rural and urban projects, hiring skilled and unskilled labor from domestic markets. We will also illustrate the EOCL for the case of a project in Kenya hiring domestic labor who can alternatively work abroad. We will then turn to the issue of hiring foreign labor employed in Kenya. We will illustrate each case analytically, followed by an empirical illustration.

4.1 A Rural Project Employing Domestically Sourced Unskilled Labor

In the first case, the EOCL is estimated for an unskilled labor market with no significant distortions exist. i.e., the employer (demand side) does not pay taxes, and the worker (supply side) does not pay income taxes. It is further assumed that wages or labor demand have no fluctuations over time. Suppose a project in a rural region employs unskilled labor at the prevailing market monthly wage rate. In this case, the EOCL is the simple calculation described above. Beginning with the gross of tax supply price of labor, W_g^s, the EOCL is:

$$EOCL = W_g{}^s \tag{6}$$

Because no distortions are present, the market wage is the supply price that captures all the factors mentioned above and thus reflects the true EOCL for this type of labor. Suppose the approximate monthly market price of unskilled labor in a rural area in Kenya is KES 4,422[65], and the project will pay an amount equal to the supply price of labor ($W_g{}^s = W_p$). The EOCL is then:

$EOCL = W_g^s$ = KES 4,422

Using equation (1) for the estimation of labor externality, the LE associated with this project is:

$$LE = W_p' - EOCL$$

However, given that no social security payments would be applied, the W_p' is equal to W_p which results in no labor externality (LE=0).

As can be seen from the above, there is no LE in this first case. Because no distortions occur in this market, there is no externality generated from the reallocation of labor to employment by the project from other activities. If unemployment is high in the region, then the supply price of labor

65 The gazetted monthly basic minimum wages for unskilled workers in the agricultural industry is KES 6,736. There is evidence that formal sector earnings are consistent with the regulation of wages guidelines; however, the informal sector still lags behind in complying with regulations. According to the Informal Sectors Skills and Occupations Survey (ISSOS) 2020, the mean monthly earnings of a skilled farm fishery wildlife and related worker in the informal sector of rural areas is KES 5,476. As the unskilled worker receives wages almost 1.5 times lower than those of skilled workers, the monthly market price of unskilled labor in a rural area is approximately KES 3,650. The Economic Survey Report of 2019 identifies informality as a prominent feature in the Kenyan economy, representing about 83% of the total employment in the country. Based on these facts, we assume that half of the workers are coming from the average wage rate of the informal sector, and the other half are coming from the average wage rate of the formal and informal sector's wage rates. Therefore, we estimated the monthly supply price of unskilled labor in rural area to be KES 4,422: 0.5*3650 + 0.5 * ((6736 + 3650)/2).

to the project as reflected by the market wage will be lower than it would be if the incidence of unemployment were less.

An important consideration when determining the EOCL, particularly in rural regions, is that labor allocation in the agricultural sector is greatly affected by the seasonality of agricultural activities. Seasonal changes in agricultural activities (land preparation, planting, weeding, tending crops, harvesting) result in both slack periods and peak periods of work, which in turn generate troughs and peaks in demand for rural labor. Consequently, the prevailing market wage will vary from one season to another.

This seasonal variation in the wage rate for a particular type of labor can affect the EOCL considerably. It must be accounted for in the estimation of the EOCL for labor employed for an extended period of time, such as one year. The pattern of the seasonal project demand for a particular type of labor also determines the overall EOCL for the project.

Seasonal variation in both the market wage and the labor needs of the project must be accounted for to estimate the EOCL accurately for the entire amount of unskilled labor employed by a project over the year. Equation (7) deals with this matter by expressing the EOCL for a project as the product of the monthly market wage rates (W_t) and the labor demand (L_t) for each season (month), in a location or region over the course of a year. This can be expressed as:

$$EOCL = \sum_{t=0}^{n} Lt\, Wt \tag{7}$$

Where t denotes a specific period of time and n represents the total number of time periods.

In a country that is as geographically and culturally diverse as Kenya, there will not be complete uniformity of agricultural seasons between the different parts of the country. There is variability in the level and pattern of rainfall in the different regions of Kenya, just as there are variations in the quality of the soil, the altitude, and the desires (tastes) of the different ethnic groups for various agricultural products.[66]

66 In most parts of Kenya, the rainy season runs from March to May. Many crops are planted during this time, with harvesting after the rains, with the length of time varying depending on the crop's growth season. There is a secondary rainy season in several parts of the nation that can occur at any time between July and December, depending on the region.

To illustrate, consider Table 1, which depicts a monthly market wage schedule and labor demand (in person-months) over the course of a year for a particular project designed to coincide with the agricultural cycle in a specific region in Kenya, which starts with land preparation from December to February, followed by planting activities in March. Planting is followed by weeding between April and May. In June, early crops start to become available, and harvest begins in earnest in July. In August, few agricultural activities take place.

Applying equation (7) to the data in Table 1, the annual EOCL for the project as a whole is:

$EOCL = \sum_{t=0}^{n} Lt\,Wt$
= (4250*10 + 4250*10 +6000*15 + ... + 4250*5)
= KES 419,170

Suppose the wage paid by the project is KES 6736. The financial cost to the project of hiring unskilled labor for the year is the project's wage times the 75 person-months of labor or KES 505,200. The difference between this amount and the economic opportunity cost is the value of labor externality. In this case, a project wage is not great enough to be subject to income taxes. With no social security tax, the entire amount of externality accrues to labor hired by the project as a net distributional benefit.

$LE = (W_p * n) – EOCL$

*LE = ((6736 * 75) – 419,170) = KES 86,030 for the project.*

*Labor Benefits (LB)= (Wp*n) - $\sum_{t=0}^{n} Lt\,Wt$ = 505,200 – 419,170 = 86,030 KES per Month*
Fiscal Benefits (FB) =0

Table 13 Market Wages and Labor Demand for a Project with Seasonal Agriculture

Month	Regional Market Wage (KES /month)	Labor Demand/person, Month by Project	EOCL of Total Project Labor by Month (KES)
January	4250	10	42,500
February	4250	10	42,500
March	6000	15	90,000
April	6000	5	30,000
May	5820	5	29,100
June	6736*	5	33,680
July	6736	15	101,040
August	5820	5	29,100
September	5000	0	-
October	4250	0	-
November	4250	0	-
December	4250	5	21,250
Total	-----	75	419,170

* The higher wage rates in June and July reflect the fact that the harvesting season of many crops may coincide with the planting season of the secondary rainy season in some regions in Kenya.

4.2. A Monthly Rural Project Employing Domestically Sourced Unskilled Labor from the Informal Sector to the Rural Formal Sector Jobs.

When a worker becomes employed in the formal sector of the economy, social security taxes must be paid on the wages they receive.[67] The only social security tax levied in Kenya is the National Social Security Fund (NSSF). The NSSF is a statutory savings scheme to provide for retirement. These social security taxes are 12% of the pensionable wages made up of two equal portions of 6% from the employee (T_{s1}) and 6% from the employer (T_s) subject to an upper limit of KES 2,160 for employees earning above KES 18,000. The employee contribution shall be drawn directly from his salary and wages, while the employer's contribution shall come directly from the employer.[68]

The analysis will begin with the assumption that the formal sector project pays a competitive wage so that the equation of ($W_p(1 - T_{s1}) = W_g^s\ (1 - T_{s1})$) must be valid. As the worker is moving from the informal sector to the formal sector, then the social security tax rate T_{s1} was levied on the supply price of labor in the informal sector is equal to zero. Hence, we have ($W_p(1 - T_{s1}) = W_g^s$). This equation states that the employee's net of social security wage they receive is equal to the supply price of labor which in turn is the prevailing market wage in the informal sector. Alternatively, the project wage W_p must be at least equal to $\frac{W_g^s}{1-T_{s1}}$. If the project were to paid less, then the workers would be worse off working for the project than working in the informal sector.

The cost of this labor to the project will have to include the wage rate paid to the employee plus the 6% social contribution that, by law, the employer must pay. For unskilled labor jobs, it is assumed that the wage rate is not high enough for the individual to be subject to income tax. Hence, the project wage (employer's cost W_p') is higher than the supply price (W_g^s) of unskilled labor for

67 The NSSF pension fund is supposed to provides basic financial security benefits to Kenyans who work in the formal and informal sectors of the economy. According to Kenya Social Protection Sector Annual Report 2018/19 (2020) only 15% of all workers aged 18-65 years in the country have an employer contributing to NSSF pensions, and it is expected that only a small extent of this percentage is an informal sector worker.

68 These rates are based on the New NSSF legislation (the NSSF Act 2013) was enacted on 24 December 2013 to replace the NSSF Act Cap 258. The new legislation was scheduled to take effect on 31 May 2014, but the effective date for the legislation was delayed.

this formal rural project by a total of 12%. In this case, the EOCL= W_g^s, but the LE is equal to W_p' –EOCL. Here the W_p' equals to 1.06* Wp.[69]

If the monthly market wage of unskilled labor in the informal sector (supply price W_g^s) is 7,137 KES[70], then at least the project wage (Wp) of this unskilled labor in the formal sector is

Wp = $\frac{W_g^s}{1-T_{s1}}$ = 7,137/1-0.06 = KES 7,593.

Then the labor cost to the project is therefore equal to

W_p' =1.06* Wp

W_p' = 1.06*7593= KES 8,049

Given that EOCL= W_g^s = 7137, then the LE is:

LE= W_p' -EOCL=8049 - 7137 = 912 KES per month.

As can be seen from the preceding, the monthly labor externality created in this case accrues to the government in the form of social security tax revenues.

The rate of government benefits which represents the benefits accrues to the government (fiscal benefits) to the total compensation for the employee, equals to: $\frac{W_p\,(Ts+T_{s1})}{W_p(1+Ts)} = \frac{7593*0.12}{7593*1.06} = 0.11$.

The ratio of the EOCL relative to the total compensation for the employee (W_p') is called the conversion factor (CF) for this specific type of labor. This quantity can be used to convert a project wage to its EOCL. In the above case, the conversion factor is CF= EOCL/W′p = 7137/8049 = 0.89.

69 It is worth to note that if the employees wage rate to be paid is KSh 18,000 and above, the maximum amount to be paid by the employer is KSh 1,080. In other words, if the wage rate is greater than KSh 18,000, then the effective social security tax rate would be less than 6 percent.

70 According to the Informal Sectors Skills and Occupations Survey (ISSOS) 2020, the mean monthly earnings elementary occupations in the informal sector of rural areas is KES 6,727. Taking into account that the monthly minimum wage rate for miner, stone cutter, turn boy, waiter, cook, logger, line cutter in in (all other towns rather than Nairobi, Mombasa, Kisumu Cities Mavoko, Ruiru and Limuru cities) is KES 8,366 which approximately reflects the wage rate in the formal sector, we estimated that the monthly supply price of this category of unskilled labor in rural area to be KES 7,137: 0.5*6727 + 0.5 * ((6727 + 8366)/2).

4.2.1. Monthly Wage in Formal Sector Is Higher Than the Prevailing Market Wage Rate

Suppose this formal sector employer pays a monthly wage that is 20% higher than the prevailing market wage rate (supply price), then the W_p is now equal to 7137 *1.2 = 8,564 KES per month. As a result, the project wage (employer's cost) (W_p') is equal to 1.06 * 8564=9,078 KES.

In this case, the level of income is not great enough to be subject to income taxes; however, we have the social security tax of $T_{s1} = 6\%$ paid by the employee.

In this case, similar to the case above, the EOCL is taken as the private supply price irrespective of what financial wage the project pays.

Given that EOCL= W_g^s = 7137, then the LE is:

LE= W_p' -EOCL=9078-7137=1,941 KES per month.

LB= $W_p(1 - T_{s1}) - W_g^s$ = 8564(1-0.06)-7137= 913 KES per month*

*FB= $W_p T_{s1}$ + $W_p * T_s$=8564*0.06 + 8564*0.06=1028 KES per Month*

In this case, the conversion factor is $\mathrm{CF} = \mathrm{EOCL}/\mathrm{W'p} = 7137/9078 = 0.79$. The conversion factor has been reduced as the project wage has surpassed the labor supply price.

Table 14 Summary Statistics for Rural Unskilled Labor in the Formal Sector

Case	Monthly project wage (W_p)	Monthly supply price of labor (W_g^s)	Total labor compensation (W_p')	Alternative wage rate (W_g^a)	EOCL	$C.F$	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
Rural, Unskilled, Formal Sector	7593	7137	8049	----	7137	0.89	0.11	0	0.11
Rural, Unskilled, Formal Sector	8564	7137	9078	-----	7137	0.79	0.21	0.10	0.11

4.3. A Rural Project Employing Domestic Skilled Labor with Migration from Other Labor Markets

This case considers a project that demands skilled labor in a remote region where such labor may not be available. The supply price of this labor in this region is likely to be higher than what this

labor would have been earning in the alternative urban labor markets for such skilled labor in order to derive equal utility. This is due to the fact that working conditions, costs of living, and locational preferences differ between regions.

The rural project's net of tax wage rate must be at least as high as the net of tax supply price of this labor. To retain enough skilled workers, the project wage may be higher than the prevailing market wage for a given skill in the project's area in some cases. Because the new work is in the formal sector, social security contributions must be taken into account.

When a person is employed in a market where a personal income tax exists, the EOCL is determined by the value this individual receives by supplying his labor services, which would be measured by the wage net of personal income taxes. In this case, the EOCL becomes the supply price less the amount of income taxes paid by this individual working at the supply price, plus the foregone income taxes that would have been generated elsewhere in the economy if the worker had not moved to the project region.

As a share of the project's labor, H^d will be sourced from taxed employed workers earning the alternative wage W_g^a, perhaps even in other parts of the country. The remainder of the project's labor would be sourced from the informal sector or non-market activities, which does not require adjusting for income taxes. As discussed before, in the case of the presence of distortions, the EOCL is:

$$EOCL = W_g^s - (W_g^s T - H^d W_g^a T')$$

From equation (3), we can calculate the labor externality associated with a project when distortions are present.

$$LE = W_p T'' + W_p (1-T'') + W_p * T_S - [W_g^s (1-T) + H^d W_g^a T']$$

Using the equations (4) and (5) as presented in the methodology section, provide the benefits to labor and to the government as following:

Labor benefits = $W_p (1-T'') - W_g^s (1-T)$

Government benefits= $W_p T'' + W_p * T_S - H^d W_g^a T'$

For this illustrative example, we focus on a specific subset of skilled labor with a skill at the third to fourth ISCO skill level, such as professional services. Assume the skilled professional labor require a monthly wage of KES 31,413 gross of tax and social security contributions (the supply price (W_g^s)).[71] Suppose the alternative wage rate (Wa) is 80% of the supply price (KES 25,130).

In addition to this, the supply price of labor (W_g^s) net of all taxes must be equal to the project wage (Wp) net of income and the social security taxes paid by the employee. This will be the lowest wage the project can pay and expect to get skilled labor to work for them. Incorporating the effective income tax rate and social security contribution rates described in the appendix, the individual would pay an income plus social security tax rate (T") of 9.34% on the project wage (Wp) while the tax rate corresponding to the alternative wage rate (T') is 9.72% and the income tax rate of the supply price of labor (T) is 9.34%. Hence, the relationship will hold that in this case, Wp (1-T") = W_g^s (1-T). Therefore, the total employee compensation (W_p') is equal to [$W_p (1+T_s)$] = $31{,}413 * 1.0344 = 32{,}493\ KES\ per\ month$][72]. We again assume that H^d = 0.9, given the relative tightness of the skilled labor market. The EOCL can then be estimated for this skilled labor by combining the supply price for the worker with the tax gains and losses associated with this employment. Following equation (2):

$EOCL = W_s^g - (W_s^g\ T - H^d\ W_g^a\ T')$
= 31413 – (31413*0.0934 – 0.9*25130*0.0972)
= 30,678 KES per month

The labor externality (LE) is estimated as the difference between the employer's financial cost and the EOCL for this type of skilled worker. The excess of financial wage over the economic cost reflects a net benefit to labor and government.

The total labor externality LE = W_p' - EOCL = 32,493 – 30,678= 1,815 KES per month

From equations (4) and (5), we can calculate the benefits of the labor to the project and to the government, and thus the magnitude of the labor externality:

Labor benefits = $W_p\ (1-T'')$ - $W_g^s\ (1-T)$
= 31,413 (1 – 0.0934) – 61,413 (1 – 0.0934)

71 International Labour Organization (ILO) Mean nominal monthly earnings of employees by sex and occupation (2019).

72 The employees wage rate exceeds KSh 18,000, however, the maximum contribution to be paid by the employer is KSh 1,080. Therefore, the effective social security tax rate would be 1,080/31,413=3.44%.

= 0 KES

Government benefits $= W_p\ T'' - H^d\ W_g^a\ T' + W_{p*}T_s$
= 31,413*0.0934 – 0.9*25,130*0.0972+31,413*0.0344
= *1815* KES

The sum of these two quantities is, by definition, the total labor externality:

LE = 1,815 KES per month.

The entire externality is a net gain in government revenues; however, the labor benefits are equal to zero as the supply price of labor (W_g^s) equals the project wage (W_p).

In terms of the conversion factor, it is calculated by the ratio of the EOCL to total employee compensation (W_p'). In the above case, the conversion factor for labor when the project pays a wage equal to the gross of tax supply price adjusted for the social security tax is 30,678 /32,493= 0.94.

4.3.1. The project wage (W_p) is above the supply price of labor (W_g^s)

Now suppose that the project wage (W_p) is substantially above the supply price of labor (W_g^s). Let us assume that the project wage is 20% more than the supply price of labor for workers being employed by the project. Hence, we have $W_p = W_g^s(1 + 0.2)$ = 31,413*1.20= 37,696 KES. Accordingly, the total employee compensation must include the social security tax and is equal to ($W_p' = 83{,}366 * 1.0287 = 38{,}776\ KES$).[73]

The income tax plus the social security rate (T'') corresponding to the project wage is estimated to be 12.66%. In comparison, these combined income tax rates plus the social security for the supply price of labor (T) is 9.34%. The T' which is tax rate (income tax plus social security) corresponding to the alternative wage as before, is 9.72%. Using these statistics in the example above, the EOCL can then be estimated as,

$EOCL = W_s^g - (W_s^g\ T - \mathrm{H}^{\mathrm{d}}\ W_g^a\ T')$
= 31,413– (31,413*0.0934 – 0.9*25,130*0.0972)
= 30,678 KES per month.

73 The effective social security rate in this case is 2.87%: 1080/37,696.

Accordingly, the conversion factor is 30,678/ 38,776= 0.79.

There is a net gain of KES 8,098 per month of employment of a skilled worker hired by the project because the EOCL for this type of labor is only KES 30,678 while the financial wage paid by the project is KES 38,776. The gains accrue in part to workers due to the higher wage paid by the project and in part to the government because of the gain in tax revenues.

Considering both components and applying equations (4) and (5):

Labor benefits $= W_p\,(1\text{-}T'') - W_g^s\,(1\text{-}T)$
$=37{,}696\,(1 - 0.1266) - 31{,}413\,(1 - 0.0934)$
$= 4{,}445$ KES

Government benefits $= W_p\,T'' - H^d\,W_g^a\,T' + W_p{*}T_s$
$= 37{,}696 * 0.1266 - 0.9 * 25{,}130 * 0.0972 + 37{,}696 * 0.0287$
$= 3{,}653$ KES

Both labor and government benefits add up to the total labor externality: 4,445+3,653=8,098.

Table 15 Summary Statistics for the Rural Skilled labor in a Formal Sector

Case	Monthly Project wage (W_p)	Monthly Supply price of labor (W_g^s)	Total Labor Compensation (W_p')	Alternative Wage Rate (W_g^a)	EOCL	C.F	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{GB}{W_p'}$
Rural, Skilled, Formal Sector	31,413 KES	31,413 KES	32,493 KES	25,130 KES	30,678 KES	0.94	0.06	0	0.06
Rural, Skilled, Formal Sector	37,696 KES	31,413 KES	38,776 KES	25,130 KES	30,678 KES	0.79	0.21	0.115	0.095

4.4 An Informal Urban Project Employing Locally Sourced Unskilled Labor at the Supply Price

An urban project is drawing upon unskilled labor from the informal sector. In this case, we assume that the project pays a wage equal to the prevailing market wage, which is equal to the labor supply price ($W_p = W_g^s$).

Unskilled workers in the informal sector typically do not pay social security contribution on the gross of income tax wage W_p, moreover, the typical project wage is not enough to meet the income tax threshold level. Hence, the project wage (employer's cost W_p') is also equal to the project wage (W_p).

In our analysis of the EOCL for workers employed in the informal sector of an urban economy, we recognize a close relationship between the labor market conditions of the urban areas and those of the rural economy. Migrants move into the urban sector from the rural (Countryside) as urban areas have more concentration of businesses than the rural areas. Furthermore, Agesa and Agesa (2005) mentioned that the difference between the expected wages for migrants in urban areas and non-migrants in rural areas in Kenya significantly increases the likelihood of rural-to-urban migration, mainly for males. Brauw et al. (2014) found that in six sub-Saharan African countries, including Kenya, the urban informal wages are more than double of the rural informal wages. Clearly, there appears to be a high return to moving from the rural to the urban informal sector in such countries.[74]

However, there is a growth of negative externalities or fiscal costs associated with the rural-urban migration process that the unskilled informal sector workers do not pay for. These negative externalities may include increased congestion of public services and transportation, additional crime and resulting additional security costs, pollution and government subsidies associated with increased access to health services. These pose additional economic costs on society or the government that should be reflected in the EOCL. In our example, we account for these external costs simply as a percentage K of the gross of tax supply price of labor. In the example below, we assume that this negative externality equals 6 percent of the prevailing urban market wage for unskilled labor.[75] In this case, the EOCL= Wgs+K* Wgs, and the LE is equal to W_p –EOCL.

Suppose a project in the urban area hires an unskilled worker in the informal sector. The assumed monthly wage (supply price) of an individual is KES 8,417,[76] the labor cost to the project is, therefore, equal to:

W_p' =W_p = 8,417KES

EOCL= 8417+0.06*(8417) = 8,922, then the C.E is:8922/8417= 1.06

74 This finding is consistent with the Informal Sectors Skills and Occupations Survey (ISSOS) results for Kenya which show that informal sector employees located in the urban areas have two times higher average monthly earns compared to their counterparts in rural areas.

75 Michaud, P. C., & Vencatachellum, D. (2003). Human capital externalities in South Africa. Economic Development and Cultural Change, 51(3), 603-628.

76 This wage represents the informal sector's mean monthly earnings of employees in elementary occupations in urban areas in Kenya. See, Informal Sectors Skills and Occupations Survey (ISSOS) 2020.

$LE = W_p$ –EOCL= 8417-8922= - 505 KES.

This amount of externality is incurred as a fiscal cost by the government.

Table 16 Summary Statistics for the Urban Unskilled labor in Informal sector.

Case	Monthly Project wage (W_p)	Monthly Supply price of labor (W_g^s)	Total Labor Compensation (W_p')	Alternative Wage Rate (W_g^a)	EOCL	C.F	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{GB}{W_p'}$
Urban, Unskilled, Informal Sector	8,417 KES	8,417 KES	8,417 KES	---	8,922 KES	1.06	-0.06	0	-0.06

4.5. A Formal Urban Project Employing Locally Sourced Unskilled Labor at the Supply Price

Suppose now we have a project in the formal sector in an urban area. This project requires unskilled labor, pays the required social security tax to the government, and deducts the portion of the social security tax levied on the worker's wages paid to the government. We assume that the project wage is not enough to meet the income tax threshold level. The negative fiscal externality exists associated with the resulting rural-urban migration that they do not pay for.[77] Similar to the above case, we assume that this negative externality equals 6 percent of the prevailing market wage (supply price) for unskilled labor in the urban sector.

For this type of labor, the minimum wage that can be paid to attract workers to this project must be such that the amount net of social security tax at least equals to the supply price demanded by this type of worker. If the monthly supply price of labor in the urban area $W_g^s = 11{,}112$ KES,[78] then the competitive monthly project wage must be $W_p = 1/(1-T_{s1}) = 11{,}112/(1-0.06) = 11{,}821$.

The EOCL is expressed as:
$EOCL = W_g^{s+} W_g^s K$

77 Rural unskilled workers with little or no human capital skills may migrate to urban areas. In the case of Kenya, Oyvat & Gĩthĩnji, (2020) found that individuals who have low skills and are pushed out of their home rural district by the lack of land migrate to smaller urban centers or other rural areas. Migration to Nairobi, which is more expensive, seems to require higher skills and wealth.

78 The monthly supply price is based on the average monthly minimum wages of general labourer in all urban areas in Kenya. See: Economic Survey 2020, Table 3.13: Gazetted Monthly Basic Minimum Wages in Urban Areas.

= 11,112+ (11,112*(0.06))

= 11,779 KES

As the $W_p' = W_p\,(1+T_s)$= 11,821 (1.06) =12,530 KES, hence the conversion factor is 11,779/12,530= 0.94.

The labor externality arises from differences in the financial wage paid by the project and the EOCL for this type of unskilled worker.

LE= 12,530 – 11,779 = 751.

The distribution of the labor externality and the benefits of the project to labor and the government would be calculated as follows:

LE= W_p' - EOCL

LE= $W_p\,(1+T_s) - (W_g^s + W_g^s\,K)$

Labor benefits= $W_p(1\text{-}0.06)\text{-}W_g^s$ = 11,821*(1-0.06)-11,112 = 0.

Government benefits= $W_p(T_s + T_{s1})$ - W_g^sK= (11,821*(0.06+0.06))–(11,112*0.06) =751 KES.

Table 17 Summary Statistics for the Urban Unskilled labor in a Formal Sector

Case	Annual Project wage (W_p)	Annual Supply price of labor (W_g^s)	Total Labor Compensation (W_p')	Alternative Wage Rate (W_g^a)	EOCL	C.F	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{GB}{W_p'}$
Urban, Unskilled, Formal Sector	11,821 KES	11,112 KES	12,530 KES	----	11,779 KES	0.94	0.06	0	0.06

4.6. An Urban Project Employing Locally Sourced Skilled Labor at its Supply Price (prevailing market wage)

In this case, the project under consideration is in the urban region. The project is seeking to hire a local skilled and pays the prevailing market wage for this type of labor in the project region which is 27,865 KES and is subject to the income tax. Since the new job is in the formal sector, social security payments would be applied. Given the tightness of the labor market for this type of high skilled labor, one can assume that the proportion of the project's labor that will be hired away from

an alternative job H^d is 0.9. Again, based on our assumption, the alternative wage rate (Wa) is 80% of the supply price (KES 22,292).

In this regard, this individual would pay an income plus social security tax rate of (T") 7.34% on the project wage (Wp) and 7.34% on the supply price of labor (Ws). The total effective income plus social security tax rate corresponding to the alternative wage rate (T') is 9.69%.[79]

The total labor compensation Wp' is equal to Wp (1+Ts) = 27,865 (1+0.0388) = KES 28,946. Using Eq. (2), the EOCL is:

EOCL = W_g^s - (W_g^s T – H^d W_g^a T')

= 27,865 – (27,865 *0.0734 – 0.9*22,292*0.0969)

= 27,763 KES

The corresponding labor externality is:

LE = Wp'-EOCL = 28,946 – 27,763 = 1,182 KES per month.

Labor benefits (LB) = W_p *(1-T")* - W_g^s *(1-T)*
= 27,865 * (1– 0.0734) – 27,865 * (1 – 0.0734)
= 0 KES

Government benefits (GB) = W_p T"– H^d W_g^a T'+ W_pT_s
= 27,865 *0.0734 – 0.9*22,292*0.0969 + 27,865 *0.0388
= 1,182 KES per month.

The sum of these two quantities (LB and FB) is, by definition, the total labor externality (LE), such that 0 + 1,182 = KES 1,182. And the conversion factor (CF) is =EOCL/ Wp' = 27,763/28,946= 0.96.

4.6.1 The project wage (W_p) is greater than the supply price of labor (W_g^s)

Here we reconsider the case of an urban project employing locally sourced skilled labor analyzed above (case 4.6). The only difference is that the project pays wages higher than the prevailing supply price in the region in this case. While the prevailing market wage in the region is KES

79 This rate effectively reflects only the social security tax as the designated alternative wage rate in this case is not great enough to be subject to income taxes.

27,865, the monthly wage paid by the project is KES 33,438 (or 20% greater than the supply price). This wage paid by the project will result in a different personal income tax liability for the worker hired by the project. The total labor compensation W_p' is KES 34,518 (1.0323*33,438).

Similar to the above case, T is 7.34% and T' is 9.69%; however, the income tax plus social security rate of corresponding to the project (T'') is 10.45% accordingly. Using the same value for the alternative wage W_g^a like the previous scenario, the EOCL is:

EOCL = W_g^s - (W_g^s T – H^d W_g^a T')

= 27,865– (27,865*0.0734– 0.9*22,292*0.0969)

= 27,763 KES.

The EOCL, in this case, is no different from the prior case (4.6), where the project paid the prevailing market wage. The EOCL is based on the supply price and the taxes paid on this supply price and in alternative employment. The EOCL is independent of the financial wage the project pays.

The corresponding labor externality is:

LE = Wp'-EOCL = 34,518 – 27,763 = 6,755 KES per month.

This externality accrues in part to workers due to the higher wage paid by the project and in part to the government because of the gain in tax revenues.

In this case, the benefits to labor and government are:

Labor benefits = W_p (1-T'') - W_g^s (1-T)

= 33,438 * (1 – 0.1045) – 27,865* (1 – 0.0734)

= 4,125 KES

Government benefits = W_p T''– H^d W_g^a T'+ $W_p T_s$

= 33,438 *0.1045 – 0.9*22,292*0.0969+ 33,438*0.0323

= 2,630 KES per month.

Both labor and government add up to the total labor externality: 4,125 + 2,630= 6,755.

The corresponding conversion factor is 27,763 /34,518 = 0.80.

Table 18 Summary Statistics for the Urban Skilled labor in a Formal Sector

Case	Monthly Project wage (W_p)	Monthly Supply price of labor (W_g^s)	Total Labor Compensation (W_p')	Alternative Wage Rate (W_g^a)	EOCL	C.F	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{GB}{W_p'}$
Urban, Skilled, Formal Sector	27,865 KES	27,865 KES	28,946 KES	22,292 KES	27,763 KES	0.94	0.06	0.00	0.06
Urban, Skilled, Formal Sector	33,438 KES	27,865 KES	34,518 KES	22,292 KES	27,763 KES	0.80	0.20	0.12	0.08

4.7. An Urban Project Employing Local Skilled Labor That to a Degree Would Have Migrated Abroad.

Given that certain skills of labor in Kenya are considered internationally traded and that a relatively large proportion of the country's foreign exchange is generated from remittances from overseas workers, it is necessary to estimate the impact of international migration on the economic cost of labor. [80] Kenya is one of the five highest remittance-recipient countries in Africa. It is a net inbound remittance market, receiving over USD 3 billion in 2020 (with the USA and UK as the main sending markets), compared with outflows at USD 710 million (2018).[81]

When a project is created in Kenya, and additional labor of certain occupations is hired, part of this labor comes from a reduction in the outflow of international migration. When this occurs, the EOCL must take into account any distortions associated with the retention or return of Kenyan workers who would have been employed abroad as well as the adjustment of the demand and supply of labor in the local markets.

A common phenomenon associated with having a country's citizens work abroad is that there is A stream of money being sent by a person in a foreign land to his or her home country. Following the supply price approach to the EOCL, the reduction in remittances themselves is not an economic cost, as they will be factored into the worker's supply price to the project.

80 Diaspora remittances is now Kenya's leading source of forex, ahead of tourism and agricultural exports such as tea, coffee and horticulture. Figures provided by CBK are considered as estimates due to the fact that remittances through other unofficial channels are usually not captured, meaning that dollar inflows in Kenya could be higher than what CBK reports. See, Kenyan Digest (2020). "Kenya records more remittances from its citizens working abroad": https://kenyandigest.com/kenya-records-more-remittances-from-its-citizens-working-abroad.

81 See: World Bank (2020). "Inflows: Annual Remittances Data. https://www.worldbank.org/en/topic/labormarkets/brief/migration-and-remittances.

A further adjustment needs to be made to the supply price; however, it is for the premium on foreign exchange that would have been remitted and is now forgone. Taking both the local and international labor markets adjustment into consideration, the expression for the EOCL becomes:

$$EOCL = W_g^s * (1 - T) + H^d * W_g^a * T' + H^f * R * (Ee/Em - 1) \quad (8)$$

where:

- H^d denotes the proportion of the project's demand for a given type of labor obtained from taxed employment activities in the domestic market
- H^f denotes the proportion of the project's local demand for a given type of labor sourced from reduced international out-migration
- R would denote the average amount of remittances if this worker were employed abroad
- (Ee/Em – 1) denotes the foreign exchange premium

To illustrate the situation, we consider an example in which labor is internationally mobile. The prevailing market wage rate of this labor skill in an urban area (Nairobi) is about KES 58,575 per month. Emigrant workers from Kenya are skilled and would work in, say, United Kingdom, at on average post-tax income of £15,000 (KES 2,250,000) per annum. While employees in the UK, this worker remit an average of £2,500 (KES 375,000) per year to Kenya. (IOM, 2010).[82] Taking into account all costs and benefits of returning to Kenya, the workers decide to give up a higher wage in the UK and return to Kenya to work on the project that will pay 45% greater than the market supply price (KES 85,000 per month). The effective tax income rate, including the social security paid by employee (T") corresponding to this project, is 22.31%.

To estimate the EOCL for returned migrants, we need some additional information. The labor market for this skill level is very tight, and as a result, 70 percent of the project's requirement will be met by a cutback in other employment in the region, and 30 percent is going to be met by workers who would have migrated to UK and USA.[83]

82 According to IOM, (2010) about one third (34.6%) of respondents of Kenyan diaspora members from the UK remitting £2,000 or less and one quarter (24.4%) remitting between £2,000 and £3,000 per year.

83 According to Ratha et al , (2011) UK and USA are the largest destination of high skilled Kenyan with 46% and 29% of the total high skilled migrants, respectively.

Given that the monthly project wage would be KES 85,000. Hence, the total labor compensation (W_p') is equal to 85,000*1.0127=86,080 KES.[84] We also assume that the gross of income tax wage of labor from alternative sources (W_g^a) is equal to the 80% of W_g^s that is equal to 0.80*58,575= 46,860 KES. The total income plus social security tax rates corresponding to the alternative wage rate (T') is 18.36%, and the income tax rate, including the social security corresponding to the supply price of labor (T) is 18.84%. Finally, the foreign exchange premium (Ee/Em – 1) for Kenya equals to 5%.[85] The EOCL for returned domestic labor from equation (4) is then:

$$EOCL = W_s^g(1 - T) + H_d * W_g^a * T' + H^f * R * (Ee/Em - 1)$$
$$= 58,575*(1 – 0.1884) + 0.7*46,860 *0.1836 + 0.3*31,250 *0.05$$
$$= 54,029 \text{ KES per month.}$$

The corresponding conversion factor for retained labor is 54,029 /86,080 = 0.63. In this case, the labor market externality is distributed between the labor and the government as such:

Labor benefits $= W_p (1-T'') - W_g^s (1-T)$
$= 85,000 * (1 – 0.2231) – 58,575 * (1 – 0.1884)$
$= 18,497$ KES

Government benefits $= W_p T'' + W_p T_s – H^d W_g^a T' - H^f * R * (Ee/Em - 1)$
$=85,000*0.2231+85,000*0.0127–0.7*46,860*0.1836 - 0.3*31,250*0.05$
$= 13,554$ KES per month

Table 19 Summary Statistics for the Urban Skilled labor in a Formal Sector with Abroad Migration

Case	Annual Project wage (W_p)	Annual Supply price of labor (W_g^s)	Total Labor Compensation (W_p')	Alternative Wage Rate (W_g^a)	EOCL	C.F	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{GB}{W_p'}$
Urban, Skilled, With Migration Abroad	85,000 KES	58,575 KES	86,080 KES	46,860 KES	54,029 KES	0.63	0.37	0.21	0.16

4.8. A foreign worker is hired to work in the formal sector

Many development projects employ the services of foreign skilled workers and technical staff. It is, therefore, necessary to determine the EOCL of foreign workers.[86] The EOCL, in this case, will be measured by the net-of-tax wage that the worker receives in Kenya plus an adjustment of foreign exchange premium on the proportion of the wage rate remitted by foreign-worker to account for

84 Given the upper limit of the social security contribution of 1,080, the effective social security tax rate would be 1.27% (1080/85,000).

85 The foreign exchange premium has been estimated to be 5% for Kenya.

86 The majority of foreign workers are skilled. See, Foreign Investment Survey 2020 Report, Kenya National Bureau of Statistics, (2020).

the true cost of the foreign exchange to the economy rather than just its market value. A second adjustment concerns the goods and services that foreign workers consume in Kenya. If, for example, they consume subsidized goods and services, the amount of subsidy should be included in the economic cost of labor. Similarly, if the foreign workers pay any taxes such as the value-added tax levied on the consumption of foreign workers in the host country, these taxes should be accounted as an economic benefit to the country and therefore deducted from the cost of foreign labor.

Algebraically, the economic opportunity cost of foreign labor can be expressed as:

$$EOCFL = W^f (1 - T_h) - W^f (1 - T_h)(1 - R)\, t_{VAT} + W^f (1 - T_h)\, R\, (Ee / Em - 1) + N \quad (9)$$

where:

- W^f denotes the gross of tax wage of foreign labor;
- T_h, denotes the personal income tax including the socials security of paid by employee levied by the host country on foreign labor;
- R denotes the proportion of the net of tax income repatriated by foreign labor;
- Ee/Em-1 denotes the proportion of repatriated income lost via the foreign exchange premium.
- t_{VAT} denotes the VAT rate levied on consumption; and
- N denotes the value of benefits gained by foreign workers from subsidies.

To estimate the EOCFL in Kenya, we need some additional information. The VAT rate in Kenya is currently 16%. Assume that foreign workers will need to be paid 146,666 KES (Wp) on a monthly basis; hence, the income tax rate, including the social security of paid by employees (T_h) is 25.54%.[87] Also, assume those working abroad will repatriate about one-third of their net of tax income to their home country. That is, R = 0.33. Also, in this case, we assume that the government pays no subsidies with respect to these workers, i.e., N = 0.

Applying those values to the equation for EOCL, we estimate the cost to be

87 According to Song, (2016), the income of Chinese migrants is higher than most Kenyans. Nearly one-third of the survey's participants (32%) had an annual family income between $8,000 and $16,000, 29% had an income less than $8,000, and 17% were between $16,000 and $32,000. For the purpose of this case, we assume that the annual income of the foreign worker is USD 16,000.

$EOCL = W^f (1 - T_h) - W^f (1 - T_h)(1 - R)\, t_{VAT} + Wf\ (1 - T_h)\, R\, (Ee / Em - 1) + N$

$= 146{,}666 * (1 - 0.2554) - 146{,}666 * (1 - 0.2554) * (1 - 0.33) * 0.16 + 146{,}666 * (1 - 0.2554) * 0.33 * 0.05 + 0$

= 99,298 KES per month.

LE = $(W^f(1+Ts)) - EOCL = 147{,}746 - 99{,}298 = 48{,}448$ KES per Month.

GB= $Wf(T_h + Ts) + (W^f (1 - T_h)(1 - R)\, t_{VAT}) - (Wf (1 - T_h)\, R\, (Ee / Em - 1)) - N$

$= (146{,}666 * 0.2627) + (146{,}666 * (1 - 0.2554) * (1 - 0.33) * 0.16) - (146{,}666 * (1 - 0.2554) * 0.33 * 0.05 + 0)$.

= 48,448 KES per Month

LB= 0.

Table 20 Summary Statistics for Foreign Labor

Case	Monthly Project wage (Wp)	Monthly Supply price of labor (W_g^s)	Total Labor Compensation (W_p')	Alternative Wage Rate (W_g^a)	EOCL	C.F	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{GB}{W_p'}$
Foreign Labor	146,666 KES	---	147,746 KES	---	99,298 KES	0.67	0.33	0	0.33

In this case, the government accrues the full amount of labor externality caused by using foreign workers. We are not concerned with the rise in the welfare of the foreign workers in this situation; thus, any net benefit they gain by migrating to Kenya is not included in an adjustment to the economic welfare accruing to Kenya because of the project. As previously, we can determine the conversion factor for foreign labor employed in Kenya. This quantity is 99,298 /147,746 = 0.67. The rate of government benefit is 0.33.

A summary of all cases investigated in this study is provided in table 9.

Table 21 Summary statistics of all cases

Case	Project Location	Level of Skill	Source of Workers	Distortions	W_p'	W_P	W_g^s	W_g^a	*EOCL*	*C.F*	$\frac{LE}{W_p'}$	$\frac{LB}{W_p'}$	$\frac{FB}{W_p'}$
1	Rural	Unskilled Informal Sector	Local	None	4,474	4,474	4,474	--	4,474	1	0	--	--
2	Rural	Unskilled Formal Sector	Local	Social Security	8,049	7,593	7,137	--	7,137	0.89	0.11	0.00	0.11
2.1	Rural*	Unskilled Formal Sector	Local	Social Security	9,078	8,564	7,137	--	7,137	0.79	0.21	0.10	0.11
3	Rural	Skilled Formal Sector	Local	Income Tax, Social Security	32,493	31,413	31,413	25,130	30,678	0.94	0.06	0.00	0.06
3.1	Rural*	Skilled Formal Sector	Local	Income Tax, Social Security	38,776	37,696	31,413	25,130	30,678	0.79	0.21	0.115	0.095
4	Urban	Unskilled Informal Sector	Local	None	8,417	8,417	8,417	--	8,922	1.06	-0.06	0.00	-0.06
5	Urban	Unskilled Formal Sector	Local	Social Security	12,530	11,821	11,112	--	11,779	0.94	0.06	0.00	0.06
6	Urban	Skilled Formal Sector	Local	Income Tax, Social Security	28,946	27,865	27,865	22,292	27,763	0.94	0.06	0.00	0.06
6.1	Urban*	Skilled Formal Sector	Local	Income Tax, Social Security	34,518	33,438	27,865	22,292	27,763	0.80	0.20	0.12	0.08
7	Urban	Unskilled Formal Sector	Retention of Out Migrates	Income Tax, Foreign Exchange, Social Security	86,080	85,000	58,575	46,860	54,029	0.63	0.37	0.21	0.16
8	Urban	Skilled Formal Sector	Foreign	Income Tax, Foreign Exchange, Value-added Tax, Social Security	147,746	146,666	--	--	99,298	0.67	0.33	0.00	0.33

*, shows the scenario where the project wage (W_p) is greater than the supply price of labor (W_g^s)

5. Conclusion

The labor market in Kenya, such as the economy of many low- and middle-income countries, is characterized by an abundance of labor (labor-surplus economy), especially unskilled labor (mainly in rural areas), relative to other factors of production. According to different conditions, it is typical for the economy to manifest differences between nominal wages in the formal and informal sectors of the economy, as well as seasonal and regional differences in rural and urban sector wages. These differences highlight the necessity of using the correct cost of labor in applied cost-benefit analysis.

This study estimated the economic opportunity cost of labor for the Kenya market using the supply price methodology. This methodology takes the wage offered in the project's labor market area as the starting point to determine the EOCL. It then adjusts it to account for market distortions and externalities in that market as well as in other sourcing points for project labor.

Our results revealed that the range of the EOCL in Kenya could range from near equality with the project wage for unskilled workers to about 63% of the project wage for local skilled labor who would have migrated abroad. These rates depend heavily on location and the highly differentiated skills of the labor employed. Most importantly, the wage paid by the project relative to the minimum wage required (the supply price) to attract sufficient workers with the required skills. Similarly, the consideration of foreign workers can further enrich these calculations. The preceding analysis should serve as an operational guide for estimating the EOCL in Kenya.

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Appendix A -Taxation of Earned Income in Kenya

Information provided here is tabulated from the Worldwide Personal Tax and Immigration Guide 2020-2021.

Table A1. Income Tax Brackets and Rates, Kenya (2020/2021)

Exceeding	Rate on Excess	Tax on Lower Amounts
0	10%	0
288000	25%	28800
388000	30%	53800

- Individual Income Tax is charged for each year of income on all the income of a person, whether resident or non-resident, which accrued in or was derived from Kenya.
- Every resident individual is entitled to a personal relief of Ksh. 28,800 per annum (Kshs.2,400 per month) with effect from 25th April 2020.
- Any amount paid to Non-Resident individuals regarding any employment with or services rendered to an employer who is resident in Kenya or to a permanent establishment in Kenya is subject to income tax charged at the prevailing individual income tax rates.
- Non-Residents are not entitled to any personal relief. (Individual - Residence: A person is considered to be a tax resident in Kenya if they:
    - have a permanent home in Kenya and were present in Kenya for any period in a particular year of income under consideration;
    - or do not have a permanent home in Kenya but were:
      1. present in Kenya for 183 days or more in that year of income,
      2. or present in Kenya in that year of income and in each of the two preceding years of income for periods averaging more than 122 days in each year of income.
- Social security taxes are 12% of the pensionable wages made up of two equal portions of 6% from the employee and 6% from the employer subject to an upper limit of KSh 2,160 for employees earning above KSh 18,000.
- If the employees earning above KSh 18,000, the maximum contribution is KES 1080 by each of employee and employer.

Using the information above, Table A2 demonstrates the calculation of the total effective tax rates, including both the income tax rate and the social security tax rate corresponding to the project wage used in our analysis.

Table A2. Total Effective Tax Rates

Case	Annual Income (Wp) in (KES)	Annual Taxable Income (KES)	Annual Income Taxes Paid (KES)*	Effective Average Income Tax rate	Effective Income Tax rate plus social security of 6% paid by the employee**	Total Effective Income and Social Security Tax Rates (6% paid by employee plus 6% paid by employer) **
1	53,688	53,688	--	--	--	--
2	91,116	91,116	--	--	--	6%
2.1	102,768	102,768	--	--	--	6%
3	376,956	376,956	22,239	5.90%	9.34%	12.78%
3.1	452,352	452,352	44,306	9.79%	12.66%	15.52%
4	101,004	101,004	--	--	--	--
5	141,852	141,852	--	--	--	6%
6	334,380	334,380	11,595	3.47%	7.34%	11.22%
6.1	401,256	401,256	28,977	7.22%	10.45%	13.68%
7	1,020,000	1,020,000	214,600	21.04%	22.31%	23.58%
8	1,759,992	1,759,992	436,598	24.81%	25.54%	26.28%

* When the personal tax relief is greater than the amount of income tax to be paid by an individual, no income taxes would be paid to the government. Every resident individual is entitled to a personal relief of Ksh. 28,800 per annum (Kshs.2,400 per month) with effect from 25th April 2020

** If the employees earning above KSh 18,000, the maximum contribution is KES 1080 by each of employee and employer; thus, the social security rate would be less than 6%.

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Annexure D: Social Value of Time

Estimation of National Parameters and Development of Project Case Studies for Investment Project Appraisal

Social Value of Time Report

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Presented to: THE MINISTRY OF NATIONAL TREASURY AND PLANNING, KENYA

Summary

In this manual, the social value of time (SVT) is estimated for evaluating public investments in three public sectors of Kenya: transportation, water and sanitation, and public office services. Improving the quality of and access to services in these sectors can potentially result in time savings for households and firms. Table 1 summarizes the estimated economic values of time savings in 2019 prices (the latest year for which public data was available at the time of this analysis), both in Kenyan Shillings (KES) and the United States Dollars (USD).

Panel A reports the monetary value of times savings for transportation projects in urban and rural regions per passenger and by vehicle modes. The results indicate that the time saved for truck drivers has the highest value in both urban and rural areas (115.50 and 26.94 KES per hour, respectively). However, the collective value of time savings by passenger occupancy appears to be the highest for public transportation modes, i.e., buses (1,461.02 and 340.78 KES per hour, respectively).

Table 22: Summary of estimated SVTs for Kenya by sector and by beneficiaries

Project's sector and beneficiaries		The monetary value of time savings (2019 prices)	
		KES per hour	USD per hour
Panel A. Transportation projects			
a.	*Per passenger*		
Urban			
	Light vehicles (cars & motorcycles)	66.41	0.66
	Buses	54.11	0.54
	Trucks	115.50	1.14
Rural			
	Light vehicles (cars & motorcycles)	15.49	0.15
	Buses	12.62	0.12
	Trucks	26.94	0.27
b.	*Per vehicle*		
Urban			
	Light vehicles (cars & motorcycles)	132.83	1.32
	Buses	1,461.02	14.47
	Trucks	115.50	1.14
Rural			
	Light vehicles (cars & motorcycles)	30.98	0.31
	Buses	340.78	3.37
	Trucks	26.94	0.27
Panel B. Water and sanitation projects			
Adults			
	Lower bound	21.37	0.21
	Upper bound	35.61	0.35
Children			
	Lower bound	10.68	0.11
	Upper bound	17.81	0.18
Panel C. Delivery of public services			
Personal			
	Lower bound	21.37	0.21
	Upper bound	35.61	0.35
Commercial		115.50	1.14

In Panel B, the monetary value of travel time reductions resulting from water and sanitation projects are reported for adults and children in Kenya. The estimated values indicate that an hour reduction in the time spent to fetch drinking water or access sanitation facilities can lead to time savings in the ranges of 21.37 to 35.61 KES (0.21 to 0.35 USD) and 10.68 to 17.81 KES (0.11 and 0.18 USD) for adults and children, respectively.

Panel C shows the economic benefits of time savings due to improving the efficiency of public service deliveries. The realized benefits will be substantial regardless of whether the purpose of visiting public offices is personal (e.g., medical treatments at public clinics or hospitals, applying for passports or driver's licenses, etc.) or commercial (e.g., renewing business permit or registering commercial motor vehicles). For personal visits, an hour reduction in the duration of service delivery has an approximate monetary value between 21.37 and 35.61 KES (0.21 and 0.35 USD). Given the higher opportunity cost of time among those visiting public offices for commercial purposes, the economic value of time-saving can be up to 115.50 KES (1.14 USD) per hour for them.

1. Introduction

There are many instances where public sector projects can potentially lead to time savings for citizens and firms in a country. Such projects either facilitate better utilization of existing capital stocks (e.g., road improvement projects and projects reducing the time required to obtain public services) or provide public services to areas without access to those services (e.g., water supply and sanitation projects). Therefore, estimating the social value of time (SVT) is crucial when planning agencies conduct investment appraisals to assess the optimality of the existing situation versus the economic feasibility of potential improvements.

Given that individuals can reallocate time savings to other welfare-improving activities, the social value of time saved by a project adds up to the project's total benefits. The social value of time is made up of two components: the resource value of time, which can be traded off with income (the value of working time saved), and the value of the utility derived from the time that now can be spent on other income- or non-income-generating activities. The first component corresponds to the value of time saved by those individuals who will allocate marginal savings in time to their occupation. The second component reflects the value that individuals place on adjustments of consumption patterns or modifications to their schedule of activities.

With diverse preferences among individuals in a society, it is expected that the social value of time savings ranges from as high as the prevailing market wages to as low as zero. For instance, taxi drivers, truck drivers, and traveling sales personnel will be more productive over their active working hours if they can travel at a higher average speed on the road. Or similarly, people may be spending several minutes or hours of their active working time queuing up to pay their annual road tax or to carry out banking activities. For this group of individuals, the net impact of an intervention that reduces waiting times can potentially translate into more productive working hours[88].

On the opposite extreme, there are some individuals whose supply price of time in a given activity is essentially zero: children on a road trip, infants accompanying their parents, women socializing with other women in their community while fetching drinking water from remote sources, or retired people enjoying the opportunity to go for a drive or to socialize with friends while waiting in a queue. In each case, the supply price of time for such activities might be very low or zero.

Between these two extremes, there is a distribution of the social value of time for individuals with an array of opportunity costs. The social value of time for this group of individuals is greater than zero but less than the market wage. Thus, the expected social value of time saved by an intervention (the expected benefit) should be estimated as a weighted average of the social value of time for these three groups.

Figure 1 illustrates the distribution of social value to time per hour time-saving for three groups. The first group (denoted by α) are those individuals who become more productive during

[88] It should be notified here that there are also some exceptions where the changes in a households' time allocation caused by a public sector intervention turns to be negative (i.e., a cost to the household). For example, the development of a hydro dam project may displace some households, forcing them to relocate farther away from their work or school. As a consequence, they may spend more time commuting. In this case the change in time allocation would decrease individuals' well-being and should be counted as a cost of the intervention.

working hours due to the project implementation. This group's economic value per hour of time-saving equals the average market wage rate (w). The next group (denoted by β) consists of those individuals with an opportunity cost less than the market wage rate but greater than zero. And individuals in the third group (denoted by μ), perhaps a small proportion of project beneficiaries, have a zero opportunity cost.

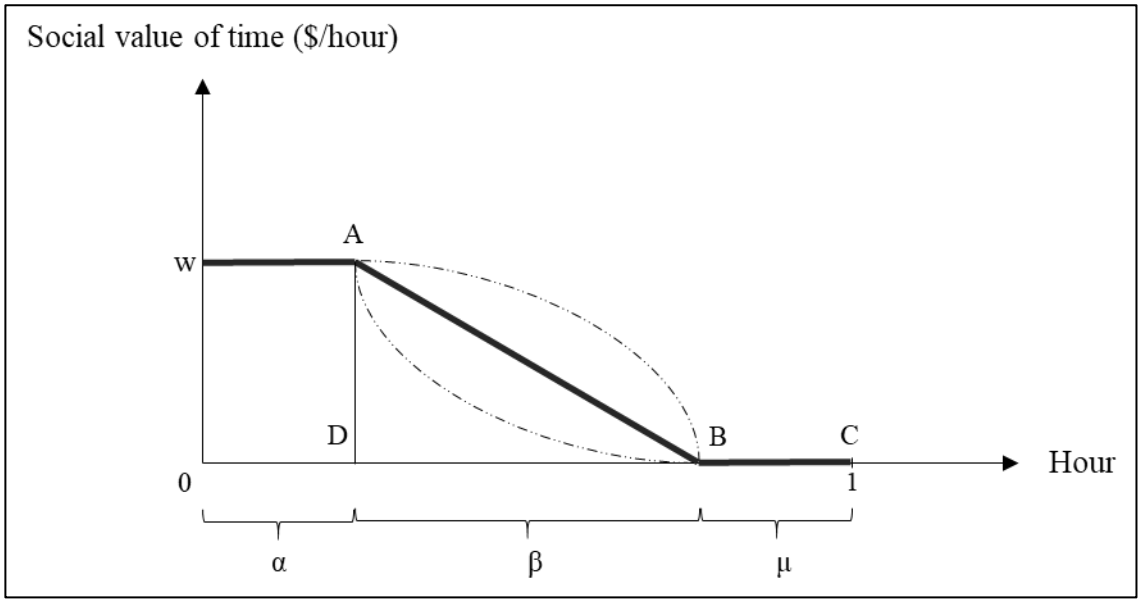


Figure 12: Distribution of economic value of time

An intervention's weighted average social value of an hour saved (or lost for projects with displacements) equals the area "0wABC" in Figure 1. Equation 1 represents the mathematical formulation of this area with three components,

$$SVT = \alpha \times (SVT_{\alpha} = w) + \beta \times SVT_{\beta} + \mu\,(SVT_{\mu} = 0) \qquad (1)$$

where, SVT_{α}, SVT_{β}, and SVT_{μ} represent the social value of time to proportions α, β, and μ, respectively. The first component captures the rectangle 0wAD, the product of α, and the average market wage rate. The area of triangle ABD represents the second component, the value of time to those with opportunity costs greater than zero but less than the average market rate. Here, we assume that the distribution between w and zero is linear, as shown by the solid line AB. So, the area of triangle ABD is equal to 0.5×w. The calculated value for area ABD would be different if our assumption regarding the distribution of values changes; a higher value will arise if the curve AB is concave to the origin and a lower value if the curve AB is convex (the dashed lines in Figure 1). Lastly, the third component of Eq. 1 captures the proportion of time savings without any social value.

The following sections will discuss how the methodology described above can be applied to investment appraisals in Kenya when estimating the social value of time for public sector projects. For this purpose, we review case studies with representative data for three sectors: transportation, water and sanitation, and public services.

2. Social Value of Time in Transportation Projects

2.1 Estimating Social Value of Time for Rural and Urban Vehicle Occupants

Our approach for estimating the social value of time is based on the opportunity cost of time for different road users. The rationale behind this approach is that individuals will value the time savings according to their opportunities for reallocation of the time savings to other activities. For some people, travel time is a component of their work time and, therefore, they have the opportunity to trade it off with more productive working hours. As a result, the opportunity cost of time sacrificed in traffic equals their hourly wage rate. But, this is not necessarily the case for all people on the road. That is why the first step of estimating the SVT for vehicle modes is to figure out the distribution of road users based on their opportunity costs of time. In the absence of data from surveys to ascertain the distribution of the opportunity costs, we assume that the distribution is similar to the distribution illustrated in Figure 1.

Additionally, we know that the opportunity cost of time saved is different for vehicle modes carrying various travelers. Hence, we begin with the information available on vehicle modes in Kenya, broadly categorized as light vehicles (cars and motorcycles), buses, and trucks. As shown in Table 2, by the end of 2019, 3.61 million vehicles were registered by the National Transport and Safety Authority (NTSA). Out of the total population of vehicles on the road, 78 percent (2.81 million) were light vehicles, 3 percent (0.11 million) were buses, and 19 percent (0.69 million) were trucks.

Table 23: Distribution of total distance traveled by vehicle modes in Kenya in 2019

Vehicle mode	Vehicle population (mil. vehicles)	Distance traveled (mil. km)	Distance traveled by occupants (mil. km)
	(1)	(2)	(3)
(1) Light vehicles (motorcycles & cars)	2.81	24,100	48,200
(2) Buses	0.11	2,728	73,656
(3) Trucks	0.69	34,230	34,230
(4) Total	**3.61**	**61,058**	**156,086**

Source: Vehicle population and types from Kenya Association of Manufacturers, KAM (2020); Annual gasoline and diesel consumption from Kenya's Energy and Petroleum Regulatory Authority, EPRA (2020).

When evaluating a transportation project, the economic value of time savings by road users should be taken into account. The methodology described in Section 1 and illustrated in Figure 1 can be used for this purpose. The first step is to estimate the proportion of distance traveled by vehicle passengers for work purposes (valued at w), non-work purposes with some value (less than w but greater than zero), and non-work purposes with zero value. So, we begin with the information about the total annual fuel consumption in Kenya that enables us to calculate the total kilometers driven in Kenya by all vehicle modes.

According to the 2020 annual report of Kenya's Energy and Petroleum Regulatory Authority (EPRA), total gasoline and diesel consumption amounted to 1,687 and 2,587 million liters in 2019, respectively. Therefore, assuming an average fuel efficiency of 100 km per 7 liters for the vehicle fleet, we can estimate how many kilometers were approximately driven by light vehicles (gasoline-engine) and buses and trucks (diesel-engine) in 2019. For light vehicles, the calculation is straightforward: 1,687 million liters of gasoline consumed by 2.81 million vehicles, each having an average fuel efficiency of 100 km per 7 liters. So, the total distance traveled by light vehicles (Table 2, row 1, column 2) can be estimated as:

$$\textit{Total distance traveled} = ((100\ \text{km})/(7\ \text{liters})) \times 1{,}687\ \text{mil. liters} = 24{,}100\ \text{mil. km}$$

For buses and trucks, the total amount of diesel consumed in 2019 is 2,587 million liters, and therefore, the total distance traveled by diesel-engine vehicles can be estimated as:

$$\textit{Total distance traveled} = ((100\ \text{km})/(7\ \text{liters})) \times 2{,}587\ \text{mil. liters} = 36{,}958\ \text{mil. km}$$

The 36,958 million kilometers traveled by diesel-engine vehicles include the distance traveled by both buses and trucks. To determine the total kilometers traveled by each, we need the relative frequency of road travel by buses to trucks. We assume that the average number of kilometers driven by an average truck is approximately two times as many kilometers as an average minibus or bus. Therefore, denoting X as the number of kilometers traveled by buses and 2X by trucks, we will have:

$$(0.11\ \text{mil. vehicles} \times X) + (0.69\ \text{mil. vehicles} \times 2 \times X) = 36{,}958\ \text{mil. km}$$

$$1.49X = 36{,}957$$

$$X = 24{,}804\ \text{km/vehicle}$$

So, the total distance traveled by buses and trucks (Table 2, rows 2 and 3, column 2) is 2,728 and 34,230 million kilometers, respectively (see below).

$$\textit{Total distance traveled by buses} = 0.11\ \text{mil. vehicle} \times 24{,}803\ \text{km/vehicle} = 2{,}728\ \text{million km}$$

$$\textit{Total distance travelled by trucks} = 0.69\ \text{mil. vehicle} \times 2 \times 24{,}803\ \text{km/vehicle} = 34{,}230\ \text{million km}$$

To estimate the total distance traveled by occupants (Table 2, column 3), we need the number of passengers associated with the utilization of each vehicle mode. Here, we assume that, on average, each car carries two people (driver plus one passenger), each bus 27 people (one driver plus 26 passengers), and each truck one driver[89]. Then, we multiply the average number of

[89] There are on average 14 seats in minibuses and 40 seats in larger buses. So, we assume an average of 27 seats for minibuses and buses combined.

passengers by the total distance traveled by each vehicle mode. As shown in Table 2, column 3, the results indicate that 156,086 million occupant-kilometers were traveled on the Kenyan roads in 2019, made up of 48,200, 73,656, and 34,230 million occupant kilometers of travel by light vehicles, buses, and trucks, respectively.

Tables 3 and 4 show the estimated parameter values for α, β, μ, the average social value of time per hour by vehicle type for urban (Table 3) and rural road users (Table 4). The following assumptions are made for the proportion of distance traveled by each mode's occupants for work purposes: 25 percent for light vehicles, 0.04 percent (1 driver out of 27 bus occupants, 1/27) for buses, and 100 percent for trucks. Assuming 10 percent of the people traveling by buses and light vehicles put a zero value on their travel time (μ = 0.10), the proportion β is equal to 0.65, 0.86, and 0 for occupants of light vehicles, buses, and trucks, respectively (column 3 in Tables 3 and 4). Figure 2 shows the distribution of the social value of time by vehicle modes.

Once the values of α, β, and μ are set, we use Equation 1 to estimate the weighted average social value of time for each mode:

$$\text{SVT}_{Light\ Vehicles} = (0.25 \times \text{w}) + (0.65 \times 0.5 \times \text{w}) + (0.10 \times 0) = 0.58\text{w} \quad (2)$$

$$\text{SVT}_{Buses} = (0.04 \times \text{w}) + (0.86 \times 0.5 \times \text{w}) + (0.10 \times 0) = 0.47\text{w} \quad (3)$$

$$\text{SVT}_{Trucks} = (\text{w}) + (0 \times 0.5 \times \text{w}) + (0.10 \times 0) = \text{w} \quad (4)$$

The weighted average SVT for each mode is a fraction of the average hourly wage (w). We use the minimum wage in urban and rural areas to approximate the average hourly wage rate. According to the Regulation of Wages Order in Kenya, the hourly wage is 115.50 KES/hour in urban regions of Kenya. The average social value of time per passenger per hour traveling by light vehicles, buses, and trucks is estimated to be 66.41 KES (0.66 USD), 54.11 KES (0.54 USD), and 115.50 (1.14 USD), respectively (Table 3, columns 6 and 7).

These estimated SVTs are for representative passengers in different vehicle modes, not for the vehicle modes themselves. When appraising road investment projects, the economic benefits of time savings are assessed by comparing travel time without- and with-project for different vehicle modes. Thus, we should break down the estimates of representative passengers for vehicle modes by multiplying the number of passengers in each vehicle mode by the corresponding SVT per hour per passenger. The SVT per hour for light vehicles (2 passengers), buses (27 passengers), and trucks (1 passenger) are 132.83 KES (1.32 USD), 1,461.02 KES (14.47 USD), and 115.50 KES (1.14 USD), respectively (Table 3, columns 8 and 9).

We repeat the same exercise for rural regions, assuming that the parameter values for α, β, and μ are identical across urban and rural areas (Table 4, columns 2 - 4). The only difference in SVT estimation for rural households is that the average hourly wage is less in rural than urban regions. The minimum wage is regulated for rural workers at 269.40 KES per day, 26.94 KES/hour assuming a 10-hour working day. In rural areas of Kenya, the average SVT per passenger per hour traveling by light vehicles, buses, and trucks is 15.49 KES (0.15 USD), 12.62 KES (0.12 USD), and 26.94 KES (0.27 USD), respectively (Table 4, columns 6 and 7). Lastly, we estimate the SVT values by vehicle modes: 30.98 KES (0.31 USD), 340.78 KES (3.37 USD), and 26.94 KES (0.27 USD) per hour for light vehicles, buses, and trucks, respectively (Table 4, columns 8 and 9).

Table 24: Estimation of Average SVT for Urban Travelers

Vehicle mode	Distance traveled by vehicle occupants % of total*	Travel purpose and value			Weighted average SVT, % of wage (w)	SVT per hour per passenger (KES)	SVT per hour per passenger (USD)**	SVT per hour per vehicle (KES)	SVT per hour per vehicle (USD)
		Work (α)	Non-work and non-zero (β)	Non-work and zero (μ)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Light vehicles	0.31	0.25	0.65	0.10	0.58	66.41	0.66	132.83	1.32
(2) Buses	0.47	0.04	0.86	0.10	0.47	54.11	0.54	1,461.02	14.47
(3) Trucks	0.22	1.00	0	0	1.00	115.50	1.14	115.50	1.14

Notes:

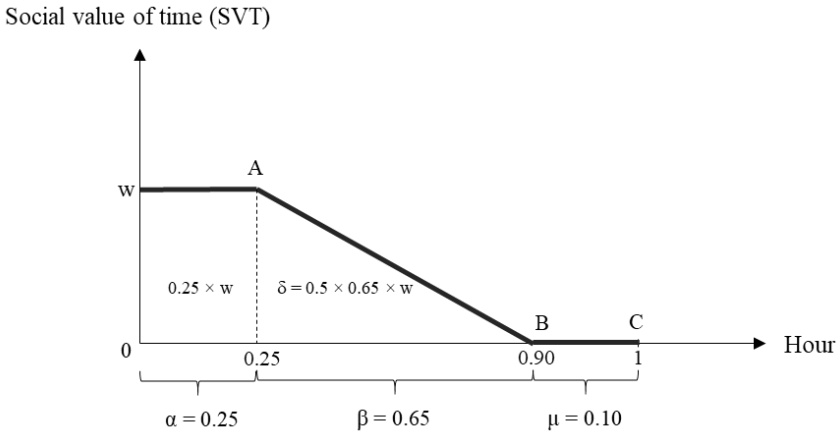
* values in column 1 are estimated by dividing the distance travelled by each vehicle mode occupants (Table 1, column 3, rows 1-3) by total distance travelled by all vehicle occupants combined (Table 1, column 3, row 4).

* an exchange rate of 101 KES/USD is used to convert KES to USD.

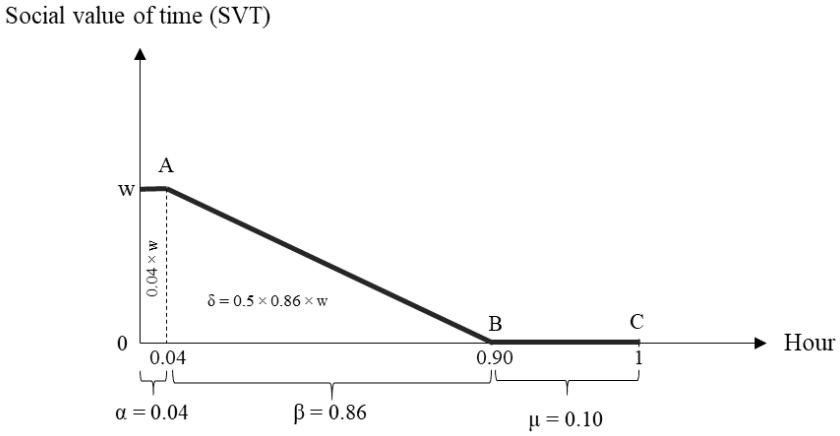
Table 25: Estimation of Average SVT for Rural Travelers

Vehicle mode	Distance travelled by vehicle occupants, % of total	Travel purpose and value			Weighted average SVT, % of wage (w)	SVT per hour per passenger (KES)	SVT per hour per passenger (USD)	SVT per hour per vehicle (KES)	SVT per hour per vehicle (USD)
		Work (α)	Non-work and non-zero (β)	Non-work and zero (μ)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Light vehicles	0.31	0.25	0.65	0.10	0.58	15.49	0.15	30.98	0.31
(2) Buses	0.47	0.04	0.86	0.10	0.47	12.62	0.12	340.78	3.37
(3) Trucks	0.22	1.00	0	0	1.00	26.94	0.27	26.94	0.27

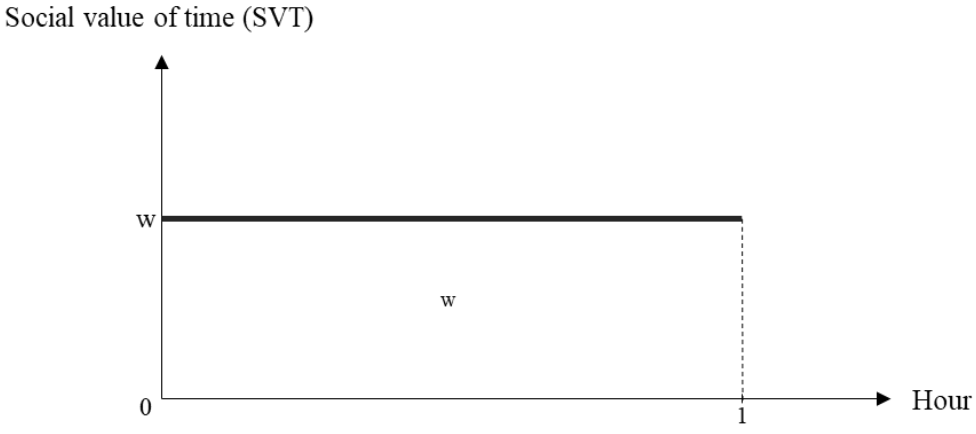
Notes:
* values in column 1 are estimated by dividing the distance travelled by each vehicle mode occupants (Table 1, column 3, rows 1-3) by total distance travelled by all vehicle occupants combined (Table 1, column 3, row 4).
* an exchange rate of 101 KES/USD is used to convert KES to USD.



Panel A: Light Vehicles



Panel B: Buses



Panel C: Trucks

Figure 13: Distribution of social value of time by vehicle modes

2.2 Projecting the SVT over the Project's Evaluation Period

The economic value of travel time savings over the project's lifetime is often a significant benefit in appraising transportation projects. Hence, we need to project the social value of time

estimates by an assumed path of growth over future periods. For this purpose, one has to adjust the real value of time savings in every particular year by the expected growth rate in real wages in that year. As real wages grow, the value of time savings grows as well. The growth rate in real wages in a country is often assumed to be approximately equal to the country's growth rate in real GDP per capita. Therefore, we need to build an index for real wage growth over time to adjust the future SVT values, as shown in Equation 5.

$$Real\ Wage\ Growth\ (RWG)\ index_t = RWG\ index_b \times (1 + RWG\ rate)^{t-b} \quad (5)$$

RWG $index_t$ is the real wage growth index in period t, RWG $index_b$ is the real wage growth index in the base period (b), and the RWG rate is the expected growth rate in GDP per capita. The value of the index in the base period, RWG $index_b$, is always set to 1 for normalization purposes. This normalization facilitates a consistent comparison of monetary values across current and future periods during the project lifetime.

Let us now look at an example to see how we can use our estimated SVT in the previous section and Eq. 5 to project SVT over the lifespan of a project. Suppose we want to evaluate the economic feasibility of a transportation project that starts in 2019 (the base year) and has a 10-year evaluation period. For simplicity, we assume that the social value of time for road users is equal to the average of the estimated SVT for all vehicle modes in column 6 of Tables 3 and 4: 78.67 KES per hour per passenger for an urban traveler and 18.35 KES per hour per passenger for a rural traveler.

The first step in projecting these economic benefits into future periods (2020 through 2028) is to determine the expected growth rate for real wages in Kenya over the project's lifetime. According to the IMF economic outlook database, Kenya's real GDP per capita has grown on average by 3.40 percent per annum from 2010 through 2019. We assume that Kenya's real GDP per capita grows at the same rate per annum over the project's lifetime. Then, using Eq. 5, we construct the real wage growth index (Table 5, row 2). Once the RWG index is built for the whole evaluation period, we can use it to project the SVT estimates for urban and rural travelers. For a specific year, we have to multiply the SVT in the base period by the RWG index of that year. For instance, the projected SVT per hour for urban travelers in 2024 is 92.99 KES, i.e., 78.67 × 1.18.

Table 26: Projection of SVT for Urban and Rural Travelers, base year = 2019

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
(1) Years passed from the base year*	0	1	2	3	4	5	6	7	8	9
(2) Real wage growth index**	1.00	1.03	1.07	1.11	1.14	1.18	1.22	1.26	1.31	1.35
(3) SVT (KES per hour – Urban)	79	81	84	87	90	93	96	99	103	106
(4) SVT (KES per hour – Rural)	18	19	20	20	21	22	22	23	24	25

Notes:
* denotes that row 1 shows the value of (t – b) in Eq. 3.
** represents that the real wage growth index is calculated using Eq. 3: $(1+0.0340)^{t-b}$

Table 6 repeats the same exercise using the estimated SVT values by vehicle modes (column 8 in Tables 2 and 3). As mentioned before, reporting SVT values by vehicle modes is helpful since most transportation projects measure costs and benefits by vehicle modes, not passengers.

Table 27: Projection of SVT for urban and rural travelers by vehicle modes (base year: 2019)

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
(1) Real wage growth index	1.00	1.03	1.07	1.11	1.14	1.18	1.22	1.26	1.31	1.35
Urban										
(2) Light vehicles	133	137	142	147	152	157	162	168	174	179
(3) Buses	1461	1511	1562	1615	1670	1727	1786	1846	1909	1974
(4) Trucks	116	119	123	128	132	137	141	146	151	156
Rural										
(5) Light vehicles	31	32	33	34	35	37	38	39	40	42
(6) Buses	341	352	364	377	390	403	416	431	445	460
(7) Trucks	27	28	29	30	31	32	33	34	35	36

The projected SVTs for urban and rural regions reflect the average magnitude of the welfare improvement of passengers traveling by each mode. This welfare improvement comes about through increased productivity during working hours, or increased utility individuals enjoy due to a one-hour reduction in travel time. Therefore, the present value of these time savings over the project's lifetime should be added to the present value of other expected benefits from improvements (such as savings in vehicle operating costs) when evaluating the economic feasibility of a transportation (or transportation-related) project.

2.3 Estimation of the SVT for Projects Starting in a Future Period

In the previous, we used an example to show how the estimated SVT values in the base year are projected over the lifespan of a project. The assumption was that the project was designed to come to service in 2019, the same year for which SVT values were estimated. However, in some cases, project appraisal needs to be conducted for projects starting in a future period. Therefore, the estimated SVT values for the base year (2019 in our example) must be adjusted before projections by the RWG index. For instance, suppose that our example project comes to service in 2026 instead of 2019. If so, the project analyst has to rebase the estimated SVT values from 2019 to 2026 before projecting the SVT values for future periods.

Rebasing is done by multiplying the estimated value of the existing base year by the ratio of nominal GDP per capita of the new base year (n) to nominal GDP per capita of the current base year (b), as shown in Eq. 6:

$$SVT_n = SVT_b \times \frac{Nominal\ GDP\ per\ capita_n}{Nominal\ GDP\ per\ capita_b} \quad (6)$$

In our example, we need the nominal GDP per capita of Kenya in 2019 and 2026. According to the IMF economic outlook database, the realized nominal GDP per capita in 2019 (listed as GDP per capita current local currency in the IMF data) is 204,629 KES, and the forecasted nominal GDP per capita in 2026 is 361,896 KES. Using this data, we rebase our estimated SVT values from 2019 to 2026.

$$SVT_{2026} = SVT_{2019} \times \frac{Nominal\ GDP\ per\ capita_{2026}}{Nominal\ GDP\ per\ capita_{2019}} \quad (7)$$

For instance, the SVTs per hour per vehicle for light vehicles in urban and rural regions in 2026 are shown in Equations 8 and 9, respectively:

$$Urban: Light\ vehicles - \ SVT_{2026} = 133 \times \frac{361{,}896}{204{,}629} = 235\ KES\ per\ hour \quad (8)$$

$$Rural: Light\ vehicles - \ SVT_{2026} = 31 \times \frac{361{,}896}{204{,}629} = 55\ KES\ per\ hour \quad (9)$$

Following the same method, we rebase the SVT estimates for other vehicle modes (see Table 7).

Table 28: Rebasing the estimated SVT values from 2019 to 2026

Vehicle mode	Urban: SVT per hour per vehicle (KES)		Rural: SVT per hour per vehicle (KES)	
	2019	2026	2019	2026
(1) Light vehicles	133	235	31	55
(2) Buses	1461	2584	341	603
(3) Trucks	116	204	27	48

Once the SVT values are estimated at 2026 prices, projections can be made into the future periods, as described in Table 6. Similarly, we consider a 10-year evaluation period from 2026 to 2035. The real wage growth index is constructed using Eq. 5, with the real wage growth rate estimated by averaging growth rate forecasts in GDP per capita from 2021 to 2026. Table 8 reports the SVT estimates at 2026 prices by vehicle mode and rural/urban status.

Table 29: Projection of SVT for urban and rural travelers by vehicle modes (base year: 2026)

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
(1) Real wage growth index	1.00	1.03	1.05	1.08	1.11	1.14	1.17	1.20	1.24	1.27
Urban										
(2) Light vehicles	235	241	248	254	261	268	275	283	290	298
(3) Buses	2,584	2,653	2,724	2,797	2,872	2,950	3,029	3,110	3,193	3,279
(4) Trucks	204	210	215	221	227	233	239	246	252	259
Rural										
(5) Light vehicles	55	56	58	59	61	63	64	66	68	70
(6) Buses	603	619	635	652	670	688	706	725	745	765
(7) Trucks	48	49	50	52	53	54	56	57	59	60

3. Social Value of Time in Water and Sanitation Projects

3.1 Estimating the SVT for the Base Period

This section reviews the current provision of water and sanitation services across Kenya and estimates the social value of time savings if improvements are implemented in providing such services. Similar to the transportation sector projects, the time savings from improved access to water and sanitation services can result in increased productivity or increased utility individuals enjoy due to reallocating the saved time to other welfare-improving activities such as leisure and child-care.

As of 2015 (the latest publicly available dataset at the time of this report), twenty-nine percent of Kenya's population did not have access to improved drinking water sources (MIS, 2015)[90]. The distribution of drinking water sources by locality reveals that the majority of the households without improved drinking water sources are rural households: 38 percent of the rural population compared to 12 percent of the urban population (Table 9).

Table 30: Distribution of households in Kenya by the source of drinking water

Characteristic	Kenya	Urban	Rural
Source of drinking water			
Improved	71%	88%	62%
Unimproved	29%	12%	38%
Time to obtain drinking water (round trip)			
Have water on premises	41%	67%	41%
Less than 30 minutes	32%	20%	32%
30 minutes or longer	27%	13%	27%

Source: 2015 Malaria Indicator Survey (MIS) Report

Moreover, fifty-nine percent of Kenyan households had to spend some time during the day to obtain drinking water. In urban regions, 20 percent of the population spends up to 30 minutes, 13 percent at least 30 minutes or longer to fetch drinking water. Bringing drinking water takes even longer for rural households: 32 percent spend up to 30 minutes, and 27 percent at least 30 minutes or longer.

Similarly, it is common that households have to spend a substantial amount of time accessing sanitation facilities. As shown in Table 10, seventy percent of Kenyan households use unimproved toilet facilities or open defecation (no facility)[91]. Slicing up the population by

[90] Improved sources of drinking water include piped water into own/neighbor dwelling, public tap, borehole, protected dug well and bottled water. Unimproved sources include unprotected dug well, unprotected spring, tanker truck and surface water.

[91] A household is classified as having access to improved facility if the facility is used only by members of one households. Different types of improved facility include: flush to piped sewer/septic tank/pit latrine, ventilated improved pit (VIP) latrine, pit latrine with a slab or composting toilet. An unimproved facility can be either a shared facility (would be an improved facility if not shared with other households) or a facility with flush not to sewer/septic tank/pit latrine, pit latrine without slab/open pit, bucket, or hanging toilet/latrine.

locality, we observe that shared toilets emerge as the typical unimproved facility in urban regions (38 percent). In contrast, unimproved facilities such as pit latrines without slab/open pit are mainly the type of facility to which rural households have access (46 percent). Open defecation is more common among the rural population (14 percent) than the urban population (3 percent). The MIS survey does not report the time spent by individuals to reach sanitation facilities. Still, households without sanitation facilities at their premises may spend 30 minutes or longer of their time during the day to access sanitation facilities.

Table 31: Distribution of households by type of and time to sanitation facilities

Household Characteristics	Kenya	Urban	Rural
Type of facility			
Improved source, not shared	30%	36%	25%
Unimproved			
Shared facility*	23%	38%	15%
Unimproved facility	36%	23%	46%
No facility (open defecation)	11%	3%	14%
Time to reach a facility			
Open defecation	21%	8%	34%
In own dwelling	38%	51%	24%
Less than 30 minutes	31%	29%	33%
More than 30 minutes	10%	11%	9%

Source: 2015 Malaria Indicator Survey (MIS) Report

Notes: * denotes that these facilities would be considered improved if two or more households did not share them.

The statistics described in Tables 9 and 10 imply that improving access to water and sanitation services generates non-health benefits, in the form of time savings, in addition to health benefits. Hence, the economic value of time savings from the society's perspective has to be considered by the project analyst when appraising projects in the water and sanitation sector.

A standard approach to estimate the economic value of time savings due to improved access to water and sanitation facilities is to conduct surveys to collect individual-level information about household's needs and preferences. Such detailed surveys provide us with the distribution of households' opportunity costs of time. In the absence of such data, however, the project analyst can use community- or regional-level data to approximate the distribution of representative households' time preferences and the monetary value of the time savings. Similarly, the analyst can rely on the existing studies in the literature. Table 11 summarizes the assumptions made by previous cost-benefit analyses on the monetary value of time savings due to improved access to water and sanitation services.

The monetary values assigned to time savings range from 30 percent to 50 percent of the average wage rate (or minimum wage in some cases) for adults and 15 percent of the average wage rate for children 15 years old or younger. Following the existing literature, we assume the following lower and upper bounds for the value of time savings after improvements in water and sanitation services in Kenya: 30 and 50 percent of the hourly wage rate for adults, and 25 and 15 percent of the hourly wage rate for children, respectively.

We use the same minimum wage figures that we used in Section 2 for transportation projects for the average wage rate values. According to the minimum wage laws in Kenya, the hourly wage for urban households is 115.50 KES/hour, whereas the hourly wage for rural workers is 26.94 KES/hour.

Table 32: Assumptions made by existing studies for the value of time savings due to water supply and sanitation interventions

Reference	Source	Location of study	The monetary value of time savings	Time savings as a percentage of the total benefits
Whittington et al. (2009)	Foundations and Trends in Microeconomics	Low-income countries	30% of the daily wage rate	15 %
Whittington et al. (2012)	World Development	Developing countries	30% of the daily wage rate	15 %
Hutton et al. (2015)	World Bank Water and Sanitation Program	South Asia	30% of wage for adults and 15 % for children ≤ 15	50 %
Hutton (2015)	Copenhagen Consensus Center	Global	30% of wage for adults and 15 % for children ≤ 15	70 %
Cook et al. (2016)	Water Resources Research	Kenya	50% unskilled wage rate	NA
Whittington et al. (2017)	Copenhagen Consensus Center	Haiti	50% of the daily wage rate	33 %
Larsen (2018)	Copenhagen Consensus Center	India	50% of the daily wage rate for people > 5	40 – 60 %
Hutton (2018)	UNICEF	India	• Household questionnaire for income-earning adults to estimate daily earnings • Minimum wage rate in rural areas for non-income earning adults • 50% of minimum wage for school-age children • no value given to the time of children ≤ 5 years	NA

Table 12 shows the estimated values vary across urban and rural regions. The value of an hour saved by urban adults ranges between 34.65 and 57.75 KES per hour (0.34 and 0.57 USD per hour). On the other hand, the value of an hour saved by rural adults lies somewhere between 8.08 and 13.47 KES per hour (0.08 and 0.13 USD per hour). The lower and upper bounds per hour of time savings for urban children are 17.33 and 28.88 KES (0.17 and 0.29 USD), and 4.04 and 6.74 KES (0.04 and 0.07 USD) for rural children, respectively. Therefore, the lower and upper bounds of average values per hour of time savings due to improvements in water and sanitation services for adults and children in Kenya will be between 21.37 KES (0.21 USD) and 35.61 KES (0.35 USD), and 10.68 KES (0.11 USD) and 17.81 KES (0.18 USD), respectively.

Table 33: Value of travel time savings for improved water and sanitation services

SVT with service improvement (KES per hour, 2019 prices)	Urban		Rural		Average	
	Adults (1)	Children (2)	Adults (3)	Children (4)	Adults (5)	Children (6)
(1) Lower bound[1]	34.65	17.33	8.08	4.04	21.37	10.68
(2) Upper bound[2]	57.75	28.88	13.47	6.74	35.61	17.81

Notes:

[1] denotes that 30% of per capita income for adults and 15% of per capita income for children are used for the lower bound estimates.

[2] denotes that 50% of per capita income for adults and 25% of per capita income for children are used for the upper bound estimates.

3.2 Projection of the SVTs over a Project's Life

Similar to the discussion in section 2.2, projecting the estimated values in the base period over the project's evaluation period is also an essential step in evaluating water and sanitation projects. We can use the same exercise described in section 2.2 (see Table 5) to project the estimated monetary value of time savings into future periods. Table 13 lists the projection of SVTs for water and sanitation projects in Kenya, with 2019 as the base year.

Table 34: Projected SVTs for water and sanitation projects in Kenya

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Real wage growth index	1.00	1.03	1.07	1.11	1.14	1.18	1.22	1.26	1.31	1.35
*Lower bound**										
Adults (KES/hour)	21.37	22.09	22.84	23.62	24.42	25.25	26.11	27.00	27.92	28.87
Children (KES/hour)	10.68	11.05	11.42	11.81	12.21	12.63	13.06	13.50	13.96	14.43
Upper bound										
Adults (KES/hour)	35.61	36.82	38.07	39.37	40.71	42.09	43.52	45.00	46.53	48.12
Children (KES/hour)	17.81	18.41	19.04	19.68	20.35	21.05	21.76	22.50	23.27	24.06

Notes: * Lower and upper bound values are the average SVT estimates listed in columns 5 and 6 of Table 12.

3.3 Estimation of the SVT for Projects Starting in a Future Period

As discussed in section 2.3, if the project appraisal is being conducted for a project which starts in a future period, there is a need to rebase the estimated SVTs from the current base period to the future base period. Here, we suppose a water and sanitation project will come into service in 2026, but we want to evaluate the project today. So, the estimated SVTs for 2019 (today) must be adjusted for the forecasted changes in Kenya's GDP per capita from 2019 to 2026 (the same exercise we did in Eq. 5).

The first step is to rebase the 2019 lower and upper bounds of SVT for adults and children to 2026 values. Eq. 10 shows an example of rebasing the lower bound SVT for adults from 2019 to 2026:

$$\text{Adults - lower bound SVT}_{2026} = \text{SVT}_{2019} \times \frac{\text{Nominal GDP per capita}_{2026}}{\text{Nominal GDP per capita}_{2019}} = 21.37 \times \frac{361{,}896}{204{,}629} = 37.79 \qquad (10)$$

Table 14 shows the average SVTs for adults and children (columns 5 and 6 of Table 12) rebased from 2019 prices to 2026 prices.

Table 35: Rebasing the estimated SVT values from 2019 to 2026 prices

SVT with service improvement (KES per hour)	2019 prices*		2026 prices**	
	Adults (1)	Children (2)	Adults (3)	Children (4)
(1) Lower bound	21.37	10.68	37.79	18.89
(2) Upper bound	35.61	17.81	62.98	31.49

Notes:
* the value of travel time savings in 2019 prices are taken from columns 5 and 6 of Table 12.
** 2026 prices are forecasted using the same approach shown in Eq. (9).

Like what we did in Table 13, we can now project the SVT values for a project that comes into service in 2026 and operates for ten years until 2035. Table 15 reflects the average magnitude of the welfare improvements accruing to adults and children without water and sanitation services at their premises. These welfare improvements come about either through increased productivity or increased utility an individual enjoys if traveling time is reduced by an hour by a project that will start in 2026.

Table 36: Projection of SVT from water and sanitation projects (KES per hour, base year: 2026)

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
(1) Real wage growth index	1.00	1.03	1.05	1.08	1.11	1.14	1.17	1.20	1.24	1.27
Lower bound										
(2) Adults	37.79	38.80	39.84	40.91	42.01	43.13	44.29	45.48	46.70	47.95
(3) Children	18.89	19.40	19.92	20.46	21.00	21.57	22.15	22.74	23.35	23.98
Upper bound										
(4) Adults	62.98	64.67	66.40	68.18	70.01	71.89	73.82	75.80	77.83	79.92
(5) Children	31.49	32.33	33.20	34.09	35.01	35.95	36.91	37.90	38.92	39.96

4. The Social Value of Time Spent Obtaining Public Services

The procedure required to obtain services from government offices is often time-consuming. Thus, improved efficiency in service delivery – including through a progressively increasing share of online services – will reduce costs for citizens and firms, freeing up their time to engage in other activities and, in some cases, income-generating activities. For instance, making online applications for passports, paying taxes, or renewing permits can significantly reduce the time required to obtain these services. Another example is making mobile-phone appointments at a public clinic or hospital rather than waiting in lines, resulting in significant time savings.

This section briefly reviews public attitudes toward the current quality of public service delivery in Kenya. Then we estimate the monetary value of time savings for households and business enterprises due to reduced turnaround times. For this purpose, we categorize those who are looking for public services into two groups: (1) those visiting public offices for personal purposes such as visiting public health facilities for medical treatments or government offices for passport applications; and (2) those visiting public offices for commercial purposes such as obtaining business licenses, renewing business permits, or paying business taxes. Identifying the distribution of the two groups across different regions of Kenya requires comprehensive individual-level data collection. In the absence of such data, however, we can still use publicly available information to approximate the extent to which Kenyan households and businesses can benefit from improvements in the efficiency of public service delivery.

According to the 2016 Afrobarometer survey in Kenya, only 11 percent of those seeking medical treatments in public clinics/hospitals receive it right away (see Table 16)[92]. A majority of the remaining 86 percent have to wait for either a short time (30 percent) or a long time (30 percent) to receive medical care. Residing in urban areas does not change this pattern since there is no significant difference in waiting times between rural and urban regions. Moreover, forty-three percent of respondents mentioned that they had to spend a few minutes (18 percent) or longer (25 percent) at the government offices to obtain official documents like a birth certificate, driver's license, passport, or voter's card, or a permit. Similar to the medical care

[92] For more information about Afrobarometer 2016 survey in Kenya visit: https://afrobarometer.org/publications/kenya-round-7-summary-results-2016.

service, there is no distinguishable difference in service delivery between urban and rural regions.

Table 37: Time to obtain medical care and public services in Kenya

Access to public services	Kenya	Urban	Rural
Time to obtain medical care in public clinics/hospitals[*]			
Right away[**]	11%	10%	11%
After a short time	30%	27%	31%
After a long time	30%	27%	31%
Time to obtain documents from government offices[***]			
Right away	5%	5%	5%
After a short time	18%	20%	16%
After a long time	25%	25%	25%

Source: Afrobarometer Round 7 - Survey in Kenya, 2016.
Notes:
[*] the question posed to the respondents: "How long did it take you to receive the medical care that you needed? Was it right away, after a short time, after a long time, or never?"
[**] Due to incomplete answers such as "Do not know" or "Never used the service" and missing observations columns do not add up to 100%.
[***] the question posed to the respondents: "How long did it take you to obtain an identity document like a birth certificate, driver's license, passport or voter's card, or a permit from the government? Was it right away, after a short time, after a long time, or never?"

These figures highlight that the economic benefits for households and firms are potentially significant if the public services delivery is improved. An example of such service improvements is the establishment of the semi-autonomous National Transport and Safety Authority (NTSA). Before NTSA, Kenya's drivers had to visit several government offices to be licensed to drive. With fragmented services and manual procedures, services used to take weeks or even months. After harmonizing key road transport departments' operations and managing road safety via NTSA, clients are served within shorter periods than in the past. Also, clients can track their application status online.

The question that arises here is that if such interventions improve the efficiency of service delivery in public offices, what monetary values should be assigned to the corresponding time savings in the project appraisal? The answer is that it depends on the clients' opportunity costs of time; those who visit public offices for personal purposes are mostly individuals who cannot afford private hospitals and healthcare services. Given that people of this economic status have socioeconomic characteristics similar to those who suffer from inadequate water supplies and sanitation services, we can reasonably assume that the monetary value of time savings for this group is, on average, similar to what we estimated for water and sanitation services in the previous section. So, the lower and upper bounds of SVT per hour for the first group amount to 21.37 KES (0.21 USD) and 35.61 KES (0.35 USD) in 2019 prices, respectively.

Nonetheless, the situation is different for those who visit public offices for business transactions of various types, most likely during working time. For these individuals, the social value of one hour saved due to reducing waiting time in queues should be valued at 100 percent of annual earnings per capita per hour. Therefore, we can use the same estimates of the minimum hourly wage of 115.50 KES per hour (1.14 USD per hour).

Table 17 reports the monetary value of time savings in Kenya if the efficiency of public service delivery is improved. It should be notified here that these values are conservative estimates since they only capture the value of waiting time saved. The actual benefits associated with reduced turnaround time are likely to be even higher because travel time, travel cost, and accommodation cost (for those traveling from rural to urban areas) are not added up here due to a lack of data availability. These costs can be substantial for many individuals and small businesses.

Table 38: The monetary value of time savings in obtaining public services

Purpose of visit	The economic value of time-saving (2019 prices)	
	KES/hour	USD/hour
(1) Personal (e.g., public health clinics/hospitals)*		
Lower bound	21.37	0.21
Upper bound	35.61	0.35
(2) Commercial (e.g., paying taxes, renewing permits)**	115.50	1.14

Notes:

* Lower and upper bound values of time savings for personal visits are assumed to be similar to the average SVT values for adults due to improved water and sanitation projects, see column 5 of Table 12.

** the value of time savings for commercial purposes is assumed to be equal to 100 percent of minimum hourly earnings in urban regions.

4.1 Projection of the SVTs over a Project's Life

Similar to the discussions in previous sections of this manual, we need to project the estimated benefits of time savings in the base period over the project's evaluation period when appraising the relevant projects or policies with a lifetime extended in future periods. We use the same exercise described in sections 2.2 and 3.2 (see Tables 5 and 13) to project the estimated monetary value of time savings into the future.

Table 39: Projected SVTs from reduced waiting time for public service delivery in Kenya

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
(1) Real wage growth index	1.00	1.03	1.07	1.11	1.14	1.18	1.22	1.26	1.31	1.35
(2) Personal purposes										
Lower bound	21.37	22.10	22.85	23.63	24.43	25.26	26.12	27.01	27.92	28.87
Upper bound	35.61	36.82	38.07	39.37	40.71	42.09	43.52	45.00	46.53	48.12
(3) Commercial purposes	115.50	119.43	123.49	127.69	132.03	136.52	141.16	145.96	150.93	156.06

4.2 Estimation of the SVT for Projects Starting in a Future Period

Following the discussions in sections 2.3 and 3.3, if the project appraisal is being conducted for a project which starts in a future period, there is a need to rebase the estimated SVT from the current base period to the future base period. Here, we suppose that the government of Kenya is assessing the feasibility of a project that comes into service in 2026. So, the estimated SVTs in Table 17 have to be adjusted to reflect the forecasted changes in nominal GDP per capita by 2026.

Table 40: Rebasing the estimated SVTs from 2019 to 2026 prices

Purpose of visit	The monetary value of time-saving (KES per hour)	
	2019 prices	2026 prices
(1) Personal		
Lower bound	21.37	37.79
Upper bound	35.61	62.98
(2) Commercial	115.50	204.27

Once we have the SVT rebased to 2026, we can project them for a project that comes into service in 2026 with an evaluation period of 10 years

Table 41: Project of SVTs for a project starting in a future period (base year: 2026)

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
(1) Real wage growth index	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.3
(2) Personal purposes										
Lower bound	37.8	38.8	39.8	40.9	42.0	43.1	44.3	45.5	46.7	48.0
Upper bound	63.0	64.7	66.4	68.2	70.0	71.9	73.8	75.8	77.8	79.9
(3) Commercial purposes	204.3	209.7	215.4	221.2	227.1	233.2	239.4	245.9	252.5	259.2

Annexes

Annex A: References

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