Accounting for Market Distortions in an Integrated Investment Appraisal Framework

Kemal Bagzibagli
Eastern Mediterranean University, North Cyprus
kemal.bagzibagli@emu.edu.tr

Glenn P. Jenkins
Queen's University, Canada
and Eastern Mediterranean University, North Cyprus
jenkins@econ.queensu.ca

Octave Semwaga
Ministry of Finance and Economic Planning, Rwanda
octave.semwaga@minecofin.gov.rw

Development Discussion Paper: 2014-05

Abstract

Public investments are key policy instruments used by governments in pursuing their overall development goals and strategies. Given the limited resources available to an economy, the chosen projects should fit into the overall development strategy, which usually concerns many stakeholder groups. Despite this fact, in practice the appraisal of most investment projects carried out by governments, multilateral financial institutions and consultants have tended to be basically a financial analysis with only a partial, if any, economic evaluation.

The stated constraints are largely the time frame in which these appraisals are to be prepared, and the lack of data for carrying out a professionally adequate economic appraisal. This paper reports on an effort in Rwanda that, we believe, has successfully addressed both of these constraints.

Our paper first presents the adjustments required to convert the financial values of investment projects into their corresponding economic values in a manner that meets a high standard of professionalism. The paper also describes the comprehensive framework and practical approaches to the estimation of the economic prices and Commodity-Specific Conversion Factors (CSCFs) for project inputs and outputs. The paper applies the framework to tradable and non-tradable goods and services in Rwanda, and estimates their CSCFs to be used in the economic appraisal of investment projects in the country.

These analytical frameworks have then been used to develop a web-based database of CSCFs for Rwanda (http://rwanda-cscf.minecofin.gov.rw), containing more than 5,000 tradable commodities, and non-tradable goods and services such as transportation, construction, electricity, and telecommunication. The database provides easy access from anywhere in the world for project appraisal specialists involved in the formulation, evaluation and implementation of projects, and allows them to conduct an up-to-date economic appraisal of investment projects in a professionally satisfactory manner.

Keywords: Economic prices, economic costs and benefits, tax externalities, tradables, importables, exportables, non-tradables

JEL Classification: D61, H23, H43

Acknowledgement: This report was prepared for the Ministry of Finance and Economic Planning of Rwanda by Cambridge Resources International Inc., USA. (World Bank funding was provided for the completion of this work.)

This page intentionally left blank.

Acknowledgement

The authors thank all of the following people for providing detailed information and data used in the estimations of the report.

Ministry of Finance and Economic Planning

Name	**Position**
Clement Ncuti	Economist
Emmanuel Nkurikiye	Public Investment Program Expert
Emmanuel Bagilizina	Coordinator of ICT
Godfrey Kabera	Director General for National Dev. Planning and Research
Jean Florent	Database and Application Expert

Rwanda Revenue Authority

Agnes Kanyangeyo	Deputy Commissioner Planning and Research
David Mutsinzi	Executive Assistant to the Commissioner of Customs
Emmanuel Gahutu	Head Tariff and Rules of Origin
Gaudence Uwimana	Principal Statistics Officer
Jacqueline Murekatete	Head Compliance and Enforcement Division
Jean Luc Amini	Business Analyst
Lucie Niyigena	Statistics Analyst Officer

National Institute of Statistics of Rwanda

Sebastian Manzi	Director, Economic Statistics
Jean Claude Mwizerwa	PRS/National Accounts

Table of Contents

List of Figures and Tables

List of Abbreviations

CIF	Cost, Insurance, and Freight
COMESA	Common Market for Eastern and Southern Africa
CSCF	Commodity-Specific Conversion Factor
EAC	East African Community
EAC CU	East African Community Customs Union
EOCFX	Economic Opportunity Cost of Foreign Exchange
FEP	Foreign Exchange Premium
FOB	Free on Board
HS	Harmonized System
NPV	Net Present Value
NTP	Premium on Non-tradable Outlays
RRA	Rwanda Revenue Authority
RWF	Rwandan franc
SACFEA	South African Conversion Factors Easy Access
SPNTO	Shadow Price of Non-tradable Outlays
USD	United States dollar
VAT	Value Added Tax
WCO	World Customs Organization

Executive Summary

Public investments are key policy instruments used by governments in pursuing their overall development goals and strategies. Given the limited resources available to an economy, the chosen projects should fit into the overall development strategy, which usually concerns many stakeholder groups. Despite this fact, traditional approaches to the appraisal of investment projects have tended to carry out a financial analysis of a project completely separately from its economic evaluation.

Jenkins et al. (2011c) propose an integrated approach where investment projects are evaluated through a financial, economic, stakeholder, and risk analysis. In other words, the approach incorporates financial and stakeholder analyses of projects in addition to a strictly economic one. The clearest motivation for such an integrated analysis is the fact that many projects that have the potential to be highly beneficial in strictly economic terms run into trouble because they face difficulties on the financial or the stakeholder side. An important feature of the economic analysis using the integrated appraisal framework is that the economic evaluation is directly linked to the financial model of the project. The economic module of project appraisal is completely consistent with the financial analysis, and allows the analyst to make inquiries into the project's financial and economic performance at the same time.

To ensure that a consistent transformation is made from the financial evaluation into the economic analysis, the model is based on the financial values and parameters of the project. A number of adjustments are made to convert these financial values into their corresponding economic values. To do this, Commodity-Specific Conversion Factors (CSCFs) are estimated for the key inputs and outputs. A conversion factor is defined as the ratio of a good's economic price to its financial price. It has the feature of being convenient in that the factor can be applied directly to convert a financial cash flow item into an economic cost or benefit as we move from the project's financial cash flow statement to its economic benefit and cost statement.

This report describes the comprehensive framework and practical approaches to the estimation of the economic prices and CSCFs for tradable and non-tradable goods and services in Rwanda to be used in the economic appraisal of investment projects in the country. The report is intended for project appraisal specialists within the various government departments, and for those employed in agencies and sub-national governments who are involved in the formulation, evaluation and implementation of projects. In order to develop a web-based database of CSCFs for Rwanda,[1] the estimation methodologies described in the report are applied to more than 5,000 tradable commodities, and non-tradable goods and services such as transportation, construction, electricity, and telecommunication.

Professional project analysts in other countries, such as South Africa,[2] have been utilizing similar software services for a faster and more reliable analytical analysis of investment

[1] The database is accessible through http://rwanda-cscf.minecofin.gov.rw/.
[2] Cambridge Resources International Inc. developed the South African Conversion Factors Easy Access (SACFEA) in 2004, and the software application is still in use.

projects. Rwanda is the first African country to deliver this software service through a website, providing access to analysts across the country through the internet.

The various distortions associated with tradable commodities in Rwanda, such as import tariffs, excise duties, export taxes, subsidies, VAT, are identified in the report. Then the CSCFs for those goods are estimated in a consistent manner in order to account for the considerable influence of the distortions on the financial price of the tradable goods in the market. The CSCFs are estimated for both cases of the project using the tradable good as an input and producing the good as the output.

The estimates of CSCFs for tradable goods can be easily updated if either the custom duty rates, value added taxes or the foreign exchange premium (FEP) change. The CSCF estimations for all of the tradable commodities in the database range from 0.3569 for cigarettes, on which high excise duties are levied, to 1.053 for exportable outputs, which generate 5.3% FEP and are currently neither taxed or subsidized in Rwanda.

The report also describes an analysis applied to the estimation of economic prices and CSCFs for non-tradables goods and services. A comprehensive formula is developed to account for all distortions in the direct and indirect markets as well as the impact of capital funds used to purchase non-traded goods. The CSCF for these goods and services are calculated so that they can easily translate the market prices used in the financial analysis into the economic prices needed to construct the economic resource statement. The conversion factors of these goods and services are presented in Table 1:

Table 1: Commodity Specific Conversion Factors for Non-Traded Goods

Item	CSCF
Transportation	0.8724
Construction	0.8840
Electricity	0.8731
Telecommunication	0.8622

The economic implications of the CSCFs estimated for tradable and non-tradable goods and services in Rwanda are as follows.

- The CSCF estimated for an input item of the project less than 1 (one) implies that the economic cost of the good or service is less than its financial cost. That is to say, the reduction in the economic net present value (NPV) caused by this project item is less than its negative impact on the financial NPV of the project. The opposite is the case if the CSCF for an input item is estimated greater than 1 (one).
- The CSCF estimated for the output of the project greater than 1 (one) implies that the economic benefit of the good or service is greater than its financial benefit. Hence, the good or service increases the economic NPV of the project more than it does the financial NPV. The opposite is the case if the CSCF estimated for the output of the project is less than 1 (one).

1. Introduction

Public investments are key policy instruments used by governments in pursuing their overall development goals and strategies. Given the limited resources available to an economy, the chosen projects should fit into the overall development strategy, which usually concerns many stakeholder groups. Despite this fact, traditional approaches to the appraisal of investment projects have tended to carry out a financial analysis of a project completely separately from its economic evaluation.

Jenkins et al. (2011c) propose an integrated approach where investment projects are evaluated through a financial, economic, stakeholder, and risk analysis. First, the financial analysis of a project investigates whether the project is financially viable from the owner's and the total investment (banker's) points of view. In situations where private investments are being undertaken with financial support from either governments or development finance institutions, it is important to know the financial viability of such activities. Second, the economic analysis of a project deals with the effect of the project on the entire society, and inquires whether the project is likely to increase the total net economic benefit of the society, taken as a whole. Third, based on the difference between the financial and economic values of cash inflows (economic benefits) and outflows (costs) of the project, the stakeholder analysis seeks to allocate the net benefits/losses (externalities) to the various parties affected. Among the main stakeholders affected by a project are generally the project's suppliers, consumers, the project's competitors, labor, and the government. Finally, once the risk variables are identified through sensitivity and scenario analysis conducted within the financial, economic, and stakeholder modules, the Monte Carlo simulation techniques are used in the risk analysis in order to measure the nature and magnitude of the variability of the project. Figure 1 illustrates the integrated investment appraisal framework.

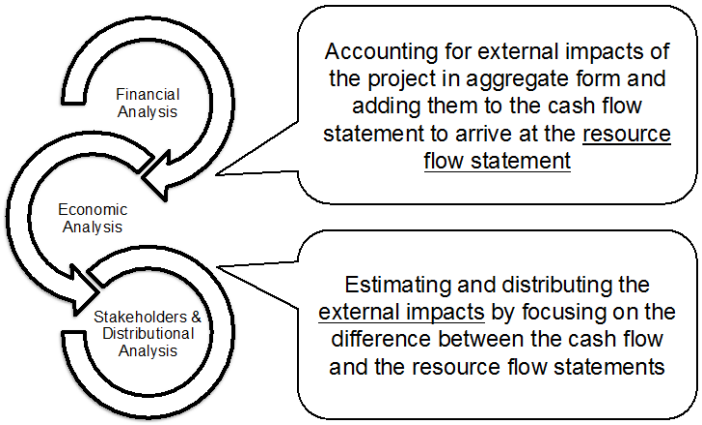

Figure 1: Integrated Investment Appraisal of Projects

An important feature of the economic analysis using the integrated appraisal framework is that the economic evaluation is directly linked to the financial model of the project. The economic module of project appraisal is completely consistent with the financial analysis, and allows the analyst to make inquiries into the project's financial and economic performance at the same time.

To ensure that a consistent transformation is made from the financial evaluation into the economic analysis, the model is based on the financial values and parameters of the project. A number of adjustments are made to convert these financial values into their corresponding economic values. To do this, CSCFs are estimated for the key inputs and outputs. A conversion factor is defined as the ratio of a good's economic price to its financial price.[3] It has the feature of being convenient in that the factor can be applied directly to convert a financial cash flow item into an economic cost or benefit as we move from the project's financial cash flow statement to its economic benefit and cost statement.

This report describes the analytical framework used to calculate conversion factors for tradable and non-tradable goods and services included in the database constructed for Rwanda. The database consists of (i) more than 5,000 tradable commodities of the Harmonized System (HS),[4] and (ii) non-tradable goods and services such as transportation, construction, electricity, and telecommunication.

The rest of the report is organized as follows. Section 2 contains the identification of the tradable and non-tradable goods and services together with the relationship between imported and importable, and exported and exportable goods. Section 3 deals with the measurement of the economic prices of tradable commodities. Section 4 describes the analytical framework applied to measure the economic prices of non-tradable goods and services when all repercussions of a project output or purchase of project inputs are taken into account. Following the description of the theoretical aspects of the economic prices of tradable and non-tradable goods and services, Section 5 demonstrates the calculation of conversion factors for Rwanda. Section 6 deals with the use of conversion factors in project appraisal. Section 7 concludes the report.

2. Relationship between Tradable and Non-tradable Goods

The distinction between tradable and non-tradable goods is quite naturally right at the core of the field of international economics, and it carries over well to the field of cost–benefit analysis. However, in this area a special case arises with regard to items that have no market prices, but must nevertheless be assigned a value for project evaluation purposes.

Examples are the value of time saved as a result of a highway improvement, or the amenity values created by a public park, or other cases in which consumer surplus benefits are assigned on top of actual market prices paid. Such items, as they are not actual outlays (or receipts), are not subject to shadow pricing. However, all actual cash outlays and receipts should in principle be classifiable as referring to one of the two broad categories, tradables and non-tradables.

[3] See Section 5 of the report for the technical details of the calculation of conversion factors.

[4] 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.

Given the fundamental differences in the processes for determining the economic prices of tradables and non-tradables, as described in Sections 3 and 4 below, these goods and services are evaluated differently in the economic appraisal of projects.

A good or service is considered internationally tradable if (i) a project's demand for it as an input is ultimately met through an expansion of imports or a reduction of exports, and (ii) its production by a project leads to a reduction in imports or an expansion of exports. Non-tradable items, on the other hand, are those that are not traded internationally.

Another classification is done for tradables and non-tradables according to where the price for the good or service in question is determined. That is to say, the good should be considered (i) tradable when its price is set in the world market, and (ii) non-tradable when the local demand and supply dynamics determine the price of the good. Typically, non-tradables include such items as local transportation, construction, electricity, telecommunication, water supply, all public services, hotel accommodation, real estate; goods with very high transportation costs, such as gravel; and commodities produced to meet special customs or conditions in a particular country.

Following the classification of tradables and non-tradables, it is also necessary to define the relationship between imported (exported) and importable (exportable) goods. Whilst imported goods are those produced in a foreign country but sold domestically, importable goods include imported ones and their close substitutes produced and sold in the domestic market. By the same token, exported goods are produced domestically but sold abroad; and exportable goods are the exported ones and domestically consumed goods of the same type or close substitutes to the goods being exported.

3. Economic Prices for Tradable Commodities

3.1 Identification of Tradable Commodities

The distinguishing feature of tradable goods is that changes in their demand or supply end up being reflected in the demand for or supply of foreign exchange. A project that produces more of an importable good will reduce the demand for (and therefore the amount of) imports of that good, thus reducing the demand for foreign exchange. Similarly, a project that produces more of an exportable good will ultimately add to the supply of exports and hence of foreign currency.[5] In order to value this foreign exchange, the concept of the economic opportunity cost of foreign exchange (EOCFX) is used. For the purpose of this report, it will be assumed that the real economic value (in, for example, Rwandan franc - RWF) of an incremental real dollar of foreign exchange, i.e. EOCFX, exceeds the market exchange rate by a positive premium on foreign exchange. As described by CRI in a report to MINECOFIN,[6] the FEP captures the distortions

[5] See Appendix 1 for detailed description of potential impacts of a project on the imported/importable and exported/exportable goods.

[6] "Report on the Estimation of Rwandan National Parameters for Economic Appraisal of Investment Projects".

created by the indirect taxes, trade tariffs and subsidies levied in the markets in which foreign exchange is used or generated. CRI's estimates suggest that FEP is 5.3% in Rwanda.

It is important to note that EOCFX does not account for the use or uses to which that foreign exchange may be put (e.g., by importing goods with high, medium, low, or zero import duties), or the specific distortions that might affect projects that end up generating foreign exchange (e.g., by producing export goods that are subject to either export taxes or subsidies). For instance, if foreign exchange is used to buy an import good subject to a tariff, the extra tariff revenue should be considered to be a project benefit (i.e., a financial but not an economic cost). In this case, the financial cost is greater than the economic cost by the amount of the tariff, but the economic cost must be calculated inclusive of the cost of the FEP. If the project generates foreign exchange by producing an export good subject to an export tax, on the other hand, the financial price of the output will be less than the free on board (FOB) price the country receives. The economic value of a unit of the exportable output will therefore be equal to the FOB price (converted into domestic currency using the market exchange rate) plus the economic premium for the foreign exchange generated by the project. Similar to the importable input case, the economic price of the exportable output must be calculated inclusive of the FEP.

3.2 Economic Valuation of Tradable Goods

The economic evaluation of traded outputs and inputs is a two-stage process. First, the components of the financial cost of the import or export of the good that represent resource costs or benefits are separated from the tariffs, taxes, subsidies, and other distortions that may exist in the market for the item. Second, the financial value of the foreign exchange associated with the net change in the traded goods is adjusted to reflect its economic value and is expressed in terms of the general price level.

3.2.1 Importable Goods

The financial cost of an importable input for a project can be equated to the sum of four components of the cost of an imported good; (i) the CIF price of the imported good, (ii) tariffs/taxes and subsidies, (iii) the trade margins of importers, and (iv) the costs of freight and transportation costs from the port to the project. The sum of these four items will be approximately equal to the delivered price of the input to the project, both when the good is actually directly imported and when it is produced by a local supplier.

Tariffs are often levied on the CIF price of the imported good by the importing country. These tariffs are a financial cost to the project but are not a cost to the economy because they involve a transfer of income only from the demanders to the government. Therefore, tariffs and other indirect taxes levied on the imported good should not be included in its economic price.

There are a number of tasks, including handling, distribution, and storage, for which importers and/or traders receive compensation. These are referred to as the trading margin. The trading margins are part of the economic costs of the imported good. The financial value of the trading margin may in some cases be larger than the economic cost of the resources expended. The most obvious case of this occurs when the privilege to import a good is restricted to a few

individuals through the selective issuing of import licences. In this case, the importer may be able to increase the price of the imported good significantly above the costs incurred in importing and distributing the item. These excess profits are not a part of the economic cost to the country of the imported good as they represent only income transfers from the demanders of the imports to the privileged people who obtained the import licences. Therefore, the economic cost of trading margins may be less than the financial value by the portion of the total trading margin made up of "monopoly profits".

Over and above the trading margin, there are the freight costs incurred by the importer or trader to bring the item from the port or border entry point to the project. Freight costs may vary greatly with the location of the project in the country, so it is advisable to treat these costs as a separate input. As this sector uses items that are often heavily taxed — such as petroleum products and motor vehicles — as inputs, its economic costs might be significantly less than its financial cost.[7] If the economic cost of an importable input is to be compared with its financial price, the former will consist of the CIF price plus the economic cost of the traders' services, plus the economic cost of the freight and transportation required to bring an importable good from the port to the project.[8]

3.2.2 Exportable Goods

Exportable goods that are used as inputs in a project typically have a financial price that is made up of the price paid to the producer, taxes, and freight and handling costs. However, it is not these items that are adjusted to measure the economic cost of the item: it is the economic benefits forgone by reduced exports that are the measure of economic cost for such an input. The country forgoes the world price (FOB at the port) when a new project buys items that would otherwise be exported. This part of the cost is not altered by the presence of export taxes or subsidies — these simply create differences between the internal price and the FOB price, the domestic selling price at the port being higher than the FOB price in the case of an export subsidy, and lower in the case of export tax.

However, adjustments should be made for freight and handling charges. To obtain the economic benefit forgone by using an exportable good domestically, we begin with the FOB price and deduct the economic costs of the freight and the port handling charges, as these are saved when the goods are no longer exported. We then add the economic costs of freight and handling charges incurred in transporting the goods to the project.

Moreover, the economic prices for tradable goods at the port should include adjustments for the FEP, while at the project they should also include the premium on outlays made to non-traded goods and services such as handling charges and transportation costs.

[7] As we show in Section 4 of the report, it is more accurate to break the local freight costs down into different component costs and then calculate their economic costs.
[8] See Section 5 for illustrative examples of the calculation of economic prices of importable commodities.

4. Economic Prices for Non-tradable Goods and Services

4.1 Identification of Non-tradable Goods and Services

Goods and services whose domestic production satisfies all the domestic market demand for these items and whose domestic prices are not determined by their world prices are referred to as non-tradables. In other words, non-tradable items are those that are not traded internationally.

If the cost, insurance, and freight (CIF) price, adjusted to include tariffs, taxes, and import subsidies, is greater than the market price, and no imports of the good are present in the country, then it is clearly a non-tradable good from the point of view of that country, or region of the country. Imports cannot compete with domestic production, at least with the existing level of tariff protection. Alternatively, if the FOB price, excluding export duties but including any export subsidies, is less than the domestic market price of the item, and no exports of the commodity are taking place, then again it is non-tradable. The standard relationships between the adjusted CIF, adjusted FOB, and market prices are illustrated in Figure 2 for the case of limestone.

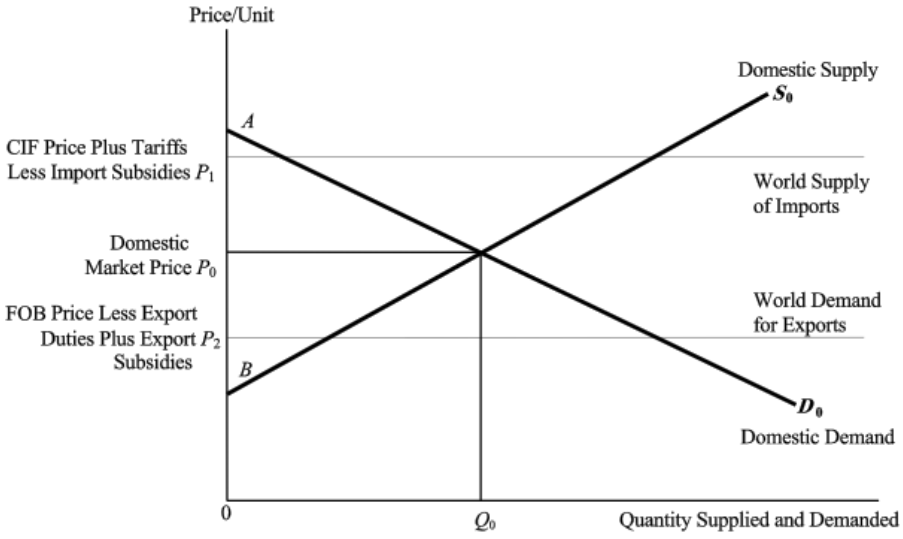

Figure 2: Determinants of Non-tradable Goods and Services (the Case of Limestone)

As the CIF price, plus tariffs less import subsidies (P_1), on limestone is above the domestic market price (P_0), the domestic demanders will be unwilling to purchase imported limestone. Similarly, since the FOB price, less export duties plus export subsidies (P_2), is less than the market price, domestic producers will be unwilling to sell abroad for a lower price than they can sell to domestic demanders.

4.2 Classification of Project Outlays

This subsection describes the classification of project outlays between the categories of tradables and non-tradables. The division of the outlays is presented in Table 2.

Table 2: Classification of Project Outlays

	Final Classification	
	Tradable (T)	*Non-tradable* (H)
1. Project purchases of tradables		
a. Actual imports by project	X	
b. Importable goods produced in the country	X	
c. Exportable goods produced in the country	X	
2. Project purchases of non-tradables $(H_k{}^p)$		
d. Project demand met through increased domestic supply		
d_1 value added in activity k		X
d_2 tradable inputs into activity k	X	
d_3 non-tradable inputs into activity k		X
e. Project demand for $(H_k{}^p)$met through displacing other demanders		
e_1 demand displaced into tradable substitutes	X	
e_2 demand displaced into non-tradable substitutes		
value added e_{2v}		X
tradable inputs e_{2t}	X	
non-tradable inputs e_{2h}		X

When the project purchases tradables directly, the purchases are classified under item 1. This is the case regardless of whether the goods bought were actually imported, or domestically produced items falling into the "importable" category, or domestically produced but falling in the "exportable" category. It is deemed that all three of these categories put pressure on the foreign exchange market, through (a) direct demand, (b) indirect demand, in which others do the importing, or (c) reduced export supply.

When the project purchases non-tradables, the situation is slightly more complicated because there are various ways in which this type of purchase can eventually be reflected in incremental demand for tradables. We first look at that part of the project's non-tradables purchased (d) that ends up as increased output of the goods or services in question. This increased output will be reflected in either increased value added (d_1), or increased tradable inputs (d_2), or increased non-tradable inputs (d_3).

However, this case tells the whole story only when the project's entire demand for non-tradables is met through increases in their supply. In the typical case, some fraction of the project's demand will be met by squeezing out other demanders for the non-tradable goods and services in question. In looking for the consequences of this process, we must ask about the activities that are stimulated as some of the previous demanders of H_k reassign that demand to other activities. In particular, it must be recognized that some of the relevant substitutes for H_k will themselves be tradable items, while others will, though non-tradable themselves, have tradable

inputs. This is why, in Table 2, there are two items (e_1) and (e_2) representing increases in tradables demand arising from what happens when the project satisfies some of its extra demand for non-tradables by displacing other demands for them.

Table 3 presents a numerical example that may help to demonstrate that the framework presented here is relatively simple and straightforward. Here the direct outlays of the project are assumed to be divided 40–60: 40 on direct purchase of tradables and 60 on direct purchase of non-tradables. All of the amount spent on tradables stays there, on the basis that there is presumably no incremental domestic production of tradables arising out of our project's demand.

Table 3: Classification of Project Outlays (Numerical Example)

	Final Classification	
	Tradable (T)	*Non-tradable* (H)
1. Project Buys Tradable Goods **(40)**		
a. Actual imports of vehicles	20	
b. Petroleum (an importable) from local sources	15	
c. Cotton (an exportable) from local sources	5	
Sub-total for tradable outlays	40	0
2. Project Buys buildings (non-tradables) **(60)**		
d. Project demand met through net increase in construction (28)		
d_1 value added in this increase in construction		14
d_2 tradable inputs used in same (materials)	6	
d_3 non-tradable inputs used in same (purchased services)		8
e. Project demand met through displacing other construction (32)		
e_1 demand displaced into tradable substitutes (machinery & equipment)	7	
e_2 demand displaced into non-tradable substitutes (maintenance & repair)		
e_{2t} (materials)	9	
e_{2h} (purchased services)		6
e_{2v} (value added in maintenance & repair)		10
Sub-total for non-tradable outlays	22	38
Totals for project	**62**	**38**

The situation is different when it comes to the project's demand for non-tradables. In this case there is every reason to believe that some increased production will be stimulated, but that this will involve greater value added plus greater use of both tradable and non-tradable inputs. Thus, in the example of Table 3, we have 60 spent on construction of buildings by the project, of which 28 represents a net increase in construction and 32 represents a displacement of the demand of others. Of the 28 of net increase, 6 is assumed to reflect increased demand for tradable inputs (d_2), while 22 reflects either increased value added in construction (11) or increased use of non-tradable inputs (8).

We now turn to the items representing project demand met through displacing other construction. The issue here is not what resources were used to satisfy the demand before it was displaced. These resources are assumed now to be satisfying the project's demand. The key question is what resources will be used in other places to satisfy the demand of others, which the project has managed to displace.

In item (e) it is assumed that part of this displaced demand (7) moves directly to the purchase of tradable substitutes. The remaining 25 is assumed to be shifted to non-tradable substitutes. However, here it contains three components: tradable inputs (materials) taking 9, non- tradable inputs (purchased services) taking 6, and value added taking 10. Hence, the correct division of the project outlays of 100 is 62 to tradables and 38 to non-tradables, almost the reverse of the initial 40–60 division of the direct expenditures.

With regard to the 60 of non-tradables purchased, the tradable content as a proportion of the total purchased is T = 22/60 = 0.36, while for the non-tradable content the proportion is NT = 38/60 = 0.64.

This example clearly highlights that in order to estimate the economic values of project's outlays, it is not enough just to look at the project's own actual imports and actual exports. Nor is it enough to extend this by simply considering the project's direct demand for and supply of tradable and non-tradable goods and services. What is needed is a further extension to include the project's overall impact on the country's demand and supply of those particular goods and services.

The rest of this section of the report describes the analytical framework used to estimate the economic values of non-tradables in a consistent manner.

4.3 Economic Valuation of Non-tradables

The process of estimating the economic costs or benefits of tradable goods is simplified by the assumption that world prices of these goods and services can be taken as given. Unfortunately, the analysis is more complicated for non-tradable goods. However, it is similar to the tradable case when supplies of the non-tradable good in question are highly elastic. In such a case, when more of a non-tradable is purchased by a project, any tax paid on the input's purchase is included in the project's financial cost. Such taxes are excluded from the costs when estimating the economic cost of the input since the tax is not a true economic cost.

When a non-tradable good or service is produced purely by non-tradable inputs, the premium for expenditures on non-tradable goods and services (NTP) (calculated from the estimate of the shadow price of non-tradable outlays, SPNTO) should be added to the net-of-tax financial cost of the item purchased. The estimated value of NTP captures the value of the externalities lost when funds to finance the project's costs are raised from the capital market and the proceeds used to buy non-tradable goods. The converse is also true. The value of NTP also measures

the value of the externalities gained per dollar of output produced when the project sells a non-tradable output. CRI's estimates suggest that NTP is 1.05% in Rwanda.[9]

If the project produces or demands a standard non-tradable good with an upward-sloping supply curve and downward-sloping demand curve, the economic value of the good is determined by its demand and supply as well as the impact of the act on the rest of the economy. These cases are discussed in detail in the following sections.

4.3.1 A Non-tradable Good in the Standard Supply and Demand Framework

Many markets for non-tradables (whether these are items that are produced by a project or goods and services that are purchased to build or operate a project) are characterized by upward-sloping supply curves. This section will first consider the steps in the economic evaluation of an output of a project that changes the price of the good or service. It will then describe the way in which this mechanism can be used to value the economic cost of non-tradable inputs purchased by a project.

Economic Value of a Non-tradable Output of a Project

For some non-tradable goods, the increase in output of a new project will lower the price of the good and hence cause some displacement of alternative sources of supply. At the same time, the lower price will create some incremental demand. This is a natural outcome of the standard supply and demand framework with upward-rising supply and downward-sloping demand curves. In this case, some fraction of the output of the new project will be reflected in a movement backward along the supply curve of the other sources of supply of the same goods, plus a movement forward along the total market-demand curve for the good in question. The fractions applying to supply and demand (W_s and W_d) can be calculated using the price elasticity of supply (ϵ_s) and demand (η_d) for the goods[10] as $W_s = \epsilon_s/(\epsilon_s - \eta_d)$ and $W_d = -\eta_d/(\epsilon_s - \eta_d)$.

The economic prices associated with the changes in supply and demand as a result of a project are measured using the principles of applied welfare economics. Let ${P_x}^s$ be the supply price per unit produced by those suppliers other than the project, and ${P_x}^d$ be the demand price per unit by domestic demanders of the good in question (project output plus other supply). The economic price (${P_x}^e$) per unit of a non-tradable good x produced by a project can be measured by a weighted average of its supply price (${P_x}^s$) and the demand price (${P_x}^d$). The weights reflect the responsiveness of existing suppliers and demanders to changes in the price of the non-tradable good. That is:

$$ {P_x}^e = {W_x}^s {P_x}^s + {W_x}^d {P_x}^d \qquad (1) $$

where ${W_x}^s + {W_x}^d = 1$.

[9] See the "Report on the Estimation of Rwandan National Parameters for Economic Appraisal of Investment Projects" for details.

[10] The relevant elasticities are those that would characterize the markets in reaction on average over the life of the project.

Let us now introduce distortions in the output market for the item. Suppose there is a production subsidy k_x expressed as a proportion of the net-of-subsidy price.[11] In our terminology, the marginal cost of production is defined as the good's supply price ${P_x}^s$. In addition, there is a value added tax (VAT) levied at the rate of ${t_x}^v$ on the market price ${P_x}^m$. This is the price that the supplier receives excluding any taxes that might have been paid by the final consumer. Thus, the supply price and demand price are ${P_x}^s = {P_x}^m(1 + k_x)$ and ${P_x}^d = P_m(1 + {t_x}^v)$, respectively. Equation (1) can then be expressed as follows:

$$ {P_x}^e = {P_x}^m(1 + {W_x}^s k_x + {W_x}^d {t_x}^v) \quad (2) $$

The conversion factor, obtained by dividing the economic value per unit of output, shown in equation (2), by its financial price exclusive of tax and subsidy, is equal to 1 plus a weighted average of the distortions in the product in the market, i.e., ${P_x}^e/{P_x}^m = (1 + {W_x}^s k_x + {W_x}^d t_x^v)$. However, if the financial price is inclusive of tax, the conversion factor will be equal to ${P_x}^e/{P_x}^m(1 + {t_x}^v)$. This may seem to be similar to the tradable case, but the issue is more complicated owing to the impact that the project's output has on other distorted markets and the reallocation of resources in the economy.

In a standard supply and demand framework with upward-rising supply and downward-sloping demand curves, the economic price $({P_x}^e)$ of a non-tradable good x can be estimated in a partial equilibrium analysis as a weighted average of the supply price $({P_x}^s)$ and the demand price $({P_x}^d)$, as expressed in equation (2). The supply price of the product is measured by what producers actually receive (i.e., gross of any subsidy and net of any tax). The demand price is measured by what demanders actually pay (gross of tax).

Suppose the good x is a telephone service produced by mobile telephones. The supply that the mobile telephone project displaces is likely to be communications services produced by the existing land-line telephones. The existing supply from all sources is assumed to receive a direct subsidy from the government equal to a fraction (k_x) of all their financial costs. Including the items discussed so far, the economic value of good x is shown by the shaded areas of Figure 3.

[11] If instead, and perhaps more realistically, the subsidy could be provided as a proportion, k_x', of the total resource costs, then ${P_x}^s \times (1 - k_x') = {P_x}^m$, hence ${P_x}^s = {P_x}^m/(1 - k_x')$.

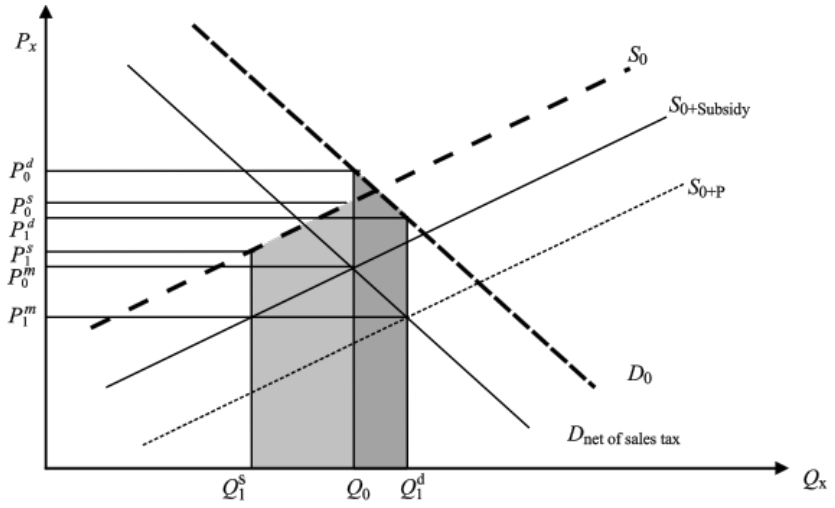

Figure 3: Economic Costs of a Project (When a Production Subsidy is Present)

On the demand side of equation (2), the amount of income spent on the incremental increase in the quantity of x demanded, measured by ${W_x}^d {P_x}^d$, will no longer be spent on other goods and services in the economy. In general, we would expect that some taxes would have been paid on these goods and services that are no longer being purchased. This effect should be captured by adding an economic cost (reducing the benefit) as the taxes associated with purchases of those goods and services are now forgone. Since it is not known precisely where those goods and services would be forgone, an average indirect tax distortion rate (d^*) on these items is assigned. Hence, the offsetting loss in taxes as a result of the diversion of demand toward good x will be ${W_x}^d {P_x}^m d^*$. The second term on the right-hand side of equation (2) now becomes ${W_x}^d {P_x}^m (1 + {t_x}^v - d^*)$.

If it was known that the additional quantity of the non-tradable good demanded was being drawn from a specific substitute good or service, y, we would want to subtract the tax t_y lost as a result of the reduction in the purchase of this good from that of the additional tax paid, ${t_x}^v$. In this case, the second term on the right-hand side of equation (2) would become ${W_x}^d {P_x}^m (1 + {t_x}^v - t^y)$.

Adjustments must also be made to the supply price of producing the good x, which will be dealt with below.

Intermediate Inputs with Finite Supply Elasticity

For those intermediate inputs that are neither internationally traded nor in perfectly elastic supply, an adjustment is required to eliminate the value of the input distortions from the value of the resources released.[12] In this case the price of the input will be lower as the demand for the input is decreased. As a consequence, both the demand and the supply of the input j will be

[12] See Jenkins et al. (2011a) for details of these cases. Here we focus on the case of finite supply elasticity which the estimations are based on.

affected, and the objective here is to measure any distortions associated with the supply and demand sides of the non-tradable intermediate inputs j caused by the additional supply of the project's non-traded good x.

As the project produces more good x, the other producers of x will reduce their supply and hence their purchases of input j. The financial cost of the input j will be ${P_j}^m(1 + {t_j}^e)$ where ${t_j}^e$ is the rate of non-creditable taxes (e.g., excise taxes) on input j.[13] Following the standard supply and demand framework with upward-rising supply and downward-sloping demand curves, because their price of j is now allowed to change, the effect will be a cutback in the supply of j. The economic cost of the input j that is due to its supply response will be measured by the response of the input supply ${W_j}^s$ multiplied by the price of the input ${P_j}^m$, or ${W_j}^s({a_{jx}}^o{P_j}^m)$, where ${a_{jx}}^o$ is the input-output coefficient of the input j used to produce a unit of x. Suppose there is a subsidy on the production of j, where k_j stands for the subsidy rate, and at the same time there may be import duties and excise taxes $g_j$on the inputs used to produce j. These duties and taxes will increase the financial price of j and must be removed to arrive at the economic cost of j. If we denote these input distortions as $g_j$then the economic value of the input can be expressed as ${W_j}^s[{a_{jx}}^o{P_j}^m(1 + k_j - g_j)]$.

At the same time, owing to the drop in the price, more of the input j will be demanded by other users of the input. We therefore want to estimate the economic value of the input j to these other demanders. In measuring the value of input j to other demanders let ${t_j}^v$ be the rate of VATs and ${t_j}^e$ be the rate of non-creditable taxes. At the same time there will be an offsetting adjustment owing to the diversion of expenditures away from other goods to good j. It is assumed that d^* is the average rate of indirect taxes that would have been paid on these diverted expenditures.[14] With this adjustment, the net economic value of the input j in the demand response should be measured by ${W_j}^d[{a_{jx}}^o{P_j}^m(1 + {t_j}^v + {t_j}^e - d^*)]$, where the gap between the economic value and the market price is reflected by the term $({t_j}^v + {t_j}^e - d^*)$.

To summarize the above discussion, when the non-tradable input j with a finite supply elasticity is used to produce a non-traded good x, the adjustment to the supply side for the distortions on input j can be measured by the excess of the financial cost of the input j over and above its corresponding economic cost. That is:

$$-{W_x}^s\{{a_{jx}}^o[{P_j}^m(1 + {t_j}^e) - [{W_j}^s{P_j}^m(1 + k_j - g_j) + {W_j}^d{P_j}^m(1 + {t_j}^v + t_j^e - d^*)]]\} \qquad (3)$$

Simplifying equation (3) by substituting ${P_j}^m(1 + {t_j}^e)$ with ${P_j}^m({W_j}^s + {W_j}^d)(1 + {t_j}^e)$, the total rate of distortion made up of the taxes and subsidies on non-tradable input j will become:

[13] If the VAT is levied on this input it is not considered to be reflected in the financial cost of the input because any VAT payments made on the input can be used as a credit against any VAT due to the government on the sales of the activity's output.

[14] Empirically d^* is estimated as the sum of all indirect taxes paid expressed as a proportion of private consumption during the same period.

$$-W_x{}^s\{a_{jx}{}^o[W_j{}^s P_j{}^m(t_j{}^e + g_j - k_j) + W_j{}^d P_j{}^m(d^* - t_j{}^v]\} \quad (4)$$

Both k_j, the subsidy on the non-tradable supply of input j, and $t_j{}^v$, the VAT on j paid by the new consumers of j, enter negatively. They will thus increase the economic cost of the final non-tradable good x. On the other hand, $t_j{}^e, g_j, d^*$ are positive, and their effect will be to reduce the economic cost of the final non-tradable good x.

Let the symbol d_j denote $t_j{}^e + g_j - k_j$ which is the sum of the distortions (d_i) associated with the supply of non-tradable intermediate input j. Thus, equation (4) can be written as:

$$-W_x{}^s\{a_{jx}{}^o[W_j{}^s P_j{}^m d_j + W_j{}^d P_j{}^m(d^* - t_j{}^v]\} \quad (4.1)$$

After making the adjustments for the distortions in the markets for intermediate inputs i and j, the economic price of the non-tradable good $x$can be measured as:

$$\begin{aligned} P_x{}^e = {} & W_x{}^s P_x{}^m(1 + k_x) + W_x{}^d P_x{}^m(1 + t_x{}^v - d^*) \\ & -W_x{}^s[\textstyle\sum_i a_{ix}^o P_i{}^m d_i + \sum_j a_{jx}^o \{W_j{}^s P_j{}^m(t_j{}^e + g_j - k_j) + W_j{}^d P_j{}^m(d^* - t_j{}^v)\}] \\ & +[P_x{}^m \times T_x \times FEP] + [P_x{}^m \times NT_x \times NTP] \end{aligned} \quad (5)$$

The input–output coefficients in equation (5) relate to the factors and factor mix used by the non-project producers of x whose markets are being affected by the project.

Economic Value of a Non-tradable Input Purchased by a Project

Figure 4 illustrates a situation in the market for an input z. This input receives a direct subsidy equal to k_z of its production cost, and when it is sold, this input is subject to a VAT of $t_z{}^v$. When the project demands more of this input, its market-demand curve will be shifted from ND_n to CD_{n+p}. This will stimulate additional supply of $(Q_1{}^s - Q_0)$ and will cause the previous consumers of z to reduce their purchases by $(Q_0 - Q_1{}^d)$.

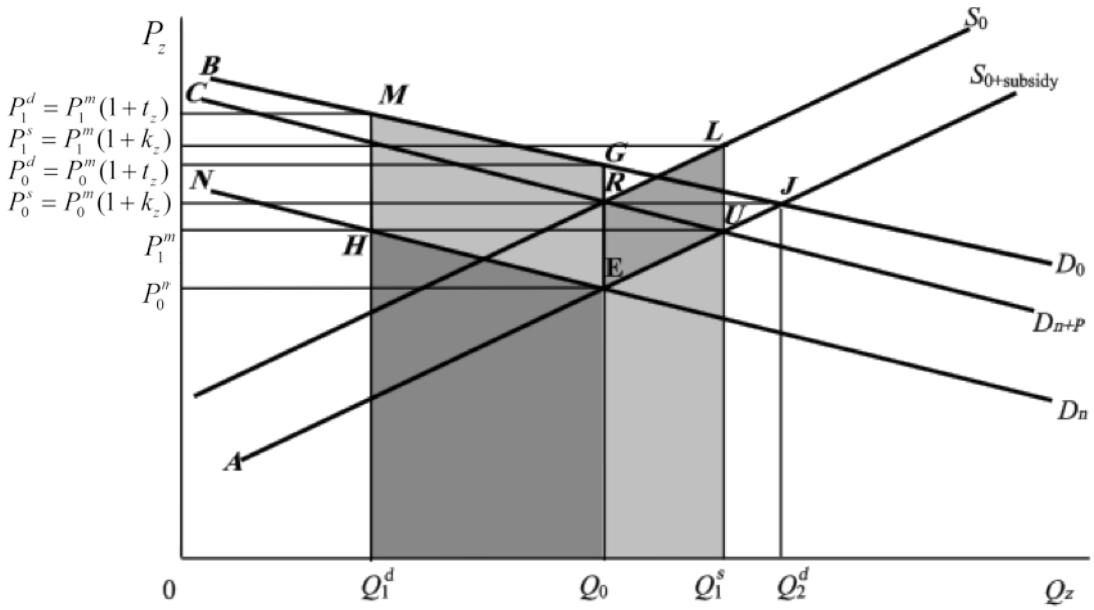

Figure 4: Economic Costs of a Project (When a Production Subsidy and a Sales Tax Are Present)

The first step in estimating the unit economic cost $({P_z}^e)$ of this non-tradable input z that is purchased by the project is to consider cost from the value of the additional resources used by producers to supply more of z and the value placed on the demand from others that has been given up because the price of z has been raised. These two costs are measured by a weighted average of its supply price $({P_z}^s)$ and its demand price $({P_z}^d)$, respectively. The weights reflect the responsiveness of existing suppliers and demanders to changes in the price of the non-tradable input. That is:

$$ {P_z}^e = {W_z}^s {P_z}^s + {W_z}^d {P_z}^d \tag{6} $$

where, ${W_z}^s + {W_z}^d = 1$.

If we account for the market distortions explicitly, then ${P_z}^s = {P_z}^m(1 + k_z)$ and ${P_z}^d = P_m(1 + t_z)$; hence, equation (6) can be written as:

$$ {P_z}^e = {W_z}^s {P_z}^m(1 + k_z) + {W_z}^d {P_z}^z(1 + {t_z}^v) \tag{7} $$

The adjustments to account for the distortions in the prices of the additional inputs used to supply z, or in the price of z when it was previously being purchased elsewhere, are of the same form as in the case of an output x in equation (5). Similarly, the adjustments are made for the generalized distortions of the FEP, when there is an impact on the demand or supply of tradable goods, and for the NTP. That is, the term ${P_z}^m \times T_z \times FEP$ measures the additional cost associated with the additional tradable inputs that are now demanded because of the project

demands for the input z. Likewise, the term $P_z^m \times NT_z \times NTP$ measures the additional cost arising from the increased use of non-tradable inputs as a consequence of the project's purchase of this non-tradable input. The final expression for the estimation of the economic price of input z in its generalized form is identical in form to the estimation of the economic price of an output. It is shown as follows:

$$P_z^e = W_z^s P_z^m(1 + k_z) + W_z^d P_z^m(1 + t_z^v - d^*) \quad (8)$$
$$-W_z^s[\sum_i a_{iz}^o P_i^m d_i + \sum_j a_{jz}^o \{W_j^s P_j^m(t_j^e + g_j - k_j) + W_j^d P_j^m(d^* - t_j^v)\}]$$
$$+[P_z^m \times T_z \times FEP] + [P_z^m \times NT_z \times NTP]$$

It is important to note that exactly the same structure and terms are present in equation (8) as in equation (5). It does not matter whether a particular good is an input being purchased or an output being produced; its economic value is the same.

5. Calculation of Commodity-Specific Conversion Factors for Rwanda

The focus of this section of the report is to carry out the estimation of CSCFs for tradable and non-tradable goods and services for the Rwandan economy. The first subsection describes the estimation of CSCFs for tradable commodities, whilst the second subsection focuses on the estimation procedure applied to non-tradable goods and services.

5.1 Conversion Factors for Tradables

5.1.1 Estimation of Economic Prices at the Port

The difference between the financial costs of a tradable commodity at the port (border) and at the project site is the financial costs of transportation and handling involved in moving the commodity from the port to the project. Likewise, the economic price of a tradable good at the port (border) will also differ from the economic price at the project site because of the economic cost of the resources used to move the good from the port (border) to the project site. While typically, the economic cost or benefit of a tradable good is measured at the project site, the price of that tradable good will be based on the price at the port. Consequently, we start the analysis by estimating the economic price of any tradable good at the port.[15,16]

[15] As a landlocked country and a member state of East African Community (EAC) and East African Community Customs Union (EAC CU), port in this context stands for the port of first entry into the community, e.g. the port of Dar-es-Salaam in Tanzania or the Kenyan Port of Mombasa.

[16] The price at the port assumes that the imported input, for example, is still on the boat (or the truck) at the border and no handling costs have been incurred. The assumption was intended to make the clear distinction between the economic cost of a pure tradable good before any transportation and handling costs have been added. As the economic cost or benefit of a good measured at the port is an intermediate step to the estimation of that cost or benefit at the project site, the assumption does not have any impact on the final economic values at the project site. The terms border and port are used interchangeably to refer to the geographical point of a country where international goods enter or exit.

Measured at the port, the economic cost of an importable input or the economic benefit of the output of an import substitution project is measured by the CIF price. As for exports, the economic benefit of an exportable output or the economic cost of an exportable input (a good that would have been exported if not used locally by a project) is measured by the FOB price.

When the CIF and FOB prices are quoted in units of foreign exchange, they directly measure the economic costs or benefits at the port. However, when these are to be expressed in units of domestic currency (RWF), they have to be multiplied by the economic exchange rate. In other words, to the extent that the economic price of foreign exchange is different from the official (financial) rate, the economic rate should be used to value each unit of foreign currency when estimating economic costs and benefits.

Alternatively, a FEP component can be added to the financial (CIF or FOB) price of the tradable good expressed in RWF to determine the price of this tradable good at the port.[17] Multiplying the CIF or FOB price by the official exchange rate and then adding the FEP would also yield the economic value of the good in RWF.

In the event that the CIF or FOB price of a tradable good was not explicitly known, but only its RWF financial price (including import duties, tariffs and other distortions) at a port was known, it would be necessary to carry out a two-stage adjustment to arrive at the economic value in RWF. The first adjustment would be to remove taxes, subsidies and other distortions built into the financial price of the good. This adjustment helps us arrive at the FOB or CIF price equivalent in RWF. The second adjustment is to add the FEP to the undistorted financial price arrived at after the first adjustment. These two stage adjustments allow us to calculate the economic price of a good at the port in RWF. Below we provide an illustrative example of how economic prices can be estimated at the port.

Examples for Computing the Financial and Economic Prices at the Port

This section presents four examples to demonstrate how to calculate financial and economic prices at the port. The figures shown here are purely for illustrative purposes.

Example 1: Irrigation Project Importing "Tubes, Pipes and Hoses, Rigid of Other Plastics"

Consider a project that imports tubes, pipes and hoses (HS 39.17.29.00) into Rwanda. There is a 25% import duty levied on the CIF price of imports of these commodities. A VAT of 18% is levied on a base that consists of the CIF price, import duties, and excise duties (if there were any). The CIF price of this project item is estimated at USD3,213 (5,950 kilogram at USD0.54/kilogram). The market exchange rate is RWF690/USD, and its economic exchange rate is RWF726.57/USD.[18]

The steps in calculating the financial prices of the imported items at the port are as follows:

[17] Algebraically, $P^e = P^w \times E^m \times (1 + FEP)$, where P^e = economic value; P^w = world financial price, E^m = Market Exchange Rate (RWF/USD – United States dollar); FEP= Foreign Exchange Premium.
[18] $E^e = E^m \times (1 + FEP)$, where FEP is estimated at 5.3% for Rwanda.

CIF price of Tubes, Pipes, and Hoses	$= \$3{,}213$
Import tariff	= 25% of CIF $= 0.25 \times 3{,}213$ $= \$803.25$
VAT	= 18% of (CIF + import duty) $= 0.18 \times (3{,}213 + 803.25)$ $= 0.18 \times 4016.25$ $= \$722.925$
Financial price of Tubes, Pipes, and Hoses at the port (including VAT) in *foreign currency*	= CIF + Tariff + VAT $= 3{,}213 + 803.25 + 722.925$ $= \$4{,}739.175$
Market exchange rate (E^m)	$= RWF690/USD$
Financial price of Tubes, Pipes, and Hoses at the port in *domestic currency*	$= \$4{,}739.175 \times RWF690/USD$ $= RWF3{,}270{,}030.75$

As the project item is one of the inputs in the irrigation process, the VAT paid on the tubes, pipes, and hoses will be fully credited. In other words, the final impact of the VAT on the financial price of the tubes, pipes, and hoses will be totally negated. Nevertheless, since the crediting takes place at a later stage and the project will initially pay the VAT, the financial price gross of VAT was estimated and will be used as a basis for calculating the conversion factor in this part of the report. In the event that the project will not pay VAT on the imported items, the financial price will be equal to the CIF price plus import tariff, i.e., $4,016.25 instead of $4,739.18.

There are two cases whether or not the VAT is included in the financial prices.

(a) If VAT is included in the financial price

If VAT is included in the observed financial price, the estimation of the economic price will have to account for the fact that the base for the import duty is different from that of the VAT. The base for the VAT is the CIF plus the custom duty. If the demand price includes the VAT, P^d would be estimated as follows:

$$\begin{aligned} P^d &= CIF \times (1 + Tariff) + CIF \times VAT \times (1 + Tariff) \\ &= \$3{,}213 \times (1 + 0.25) + \$3{,}213 \times 0.18 \times (1 + 0.25) \\ &= \$4{,}739.175 \; or \; RWF3{,}270{,}030.75 \end{aligned}$$

Given that it is the demand or financial price inclusive of VAT that we observe in the market, the economic price of the imported commodities can be derived from it as follows:

Economic price of tubes, pipes and hoses at the port in domestic currency after adjustment for FEP:

$$P^e = \frac{P^d \times (1+FEP)}{(1+Tariff) \times (1+VAT)}$$

$$= \frac{3{,}270{,}030.75 \times 1.053}{1.25 \times 1.18}$$

$$= RWF2{,}334{,}469.41$$

(b) If VAT is not included in the financial price

Economic price of tubes, pipes and hoses at the port in domestic currency after adjustment for FEP

$$P^e = \frac{P^d \times (1+FEP)}{(1+Tariff)}$$

$$= \frac{2{,}771{,}212.5 \times 1.053}{1.25}$$

$$= RWF2{,}334{,}469.41$$

Example 2: Import Substitution Project Producing "Tubes, Pipes and Hoses, Rigid of Other Plastics" in Rwanda (import subject to tariff)

In this example, we consider a hypothetical import substitution project in Rwanda that would manufacture tubes, pipes and hoses. We will first estimate the economic benefit at the port for the locally produced commodities. The CIF price of imported tubes, pipes and hoses of the same amount to those produced by the project is estimated at USD3,213. In the case of importation, the CIF price is subject to an import duty of 25%. The market exchange rate is RWF690/USD, and its economic exchange rate is RWF726.57/USD.

The import tariff increases the price of imported commodities and enables the project to produce and sell tubes, pipes and hoses at prices equal to the CIF plus the import duty. In addition, the selling price of the project will be gross of VAT unless the commodity is specifically exempted. The calculation of the financial price to the project is shown below:

CIF price of Tubes, Pipes, and Hoses	$= \$3{,}213$
Import tariff	= 25% of CIF $= 0.25 \times 3{,}213$ $= \$803.25$
VAT	= 18% of (CIF + import duty) $= 0.18 \times (3{,}213 + 803.25)$

$= 0.18 \times 4016.25$
$= \$722.925$

Financial price of Tubes, Pipes, and Hoses at the port (including VAT) in *foreign currency* = CIF + Tariff + VAT
$= 3{,}213 + 803.25 + 722.925$
$= \$4{,}739.175$

Market exchange rate (E^m) $= RWF690/USD$

Financial price of Tubes, Pipes, and Hoses at the port in *domestic currency* $= \$4{,}739.175 \times RWF690/USD$
$= RWF3{,}270{,}030.75$

It should be noted that the import duty and VAT affect the financial price of tubes, pipes hoses whether they are imported or produced locally as the distortions raise the market price at which such commodities will be sold at irrespective of whether imported or produced domestically.

The economic price (benefit) of the locally produced tubes, pipes and hoses measured at the port will be equal to the economic value of the foreign exchange savings. For the nation as a whole, the economic benefit per locally produced commodities will be equal to the sum of the CIF price and the FEP.

The economic price of locally produced tubes, pipes and hoses is therefore shown below.

Economic price of tubes, pipes and hoses at the port in domestic currency adjustment after for FEP
$= CIF(in\ \$ \times E^m) \times (1 + FEP)$
$= \$3213 \times 690RWF/\$ \times 1.053$
$= RWF2{,}334{,}469.41$

It is evident that the economic price of tubes, pipes and hoses is the same whether the project is producing or importing the commodities. If the project is producing the commodity, this will result in an economic benefit; and if the project is importing the commodity to use as an input, this will be reflected as an economic cost.

Example 3: Project to Export Maize (Excluding Seed) from Rwanda (assuming an export subsidy on maize)

Now, consider the export of maize by Rwanda. The FOB price at the port is $4,060 (28,000 kilogram at USD0.145/kilogram). Assume that the government of Rwanda provides a 10% subsidy (measured as a percentage of the FOB price) on agricultural exports. In the absence of other distortions, this would raise the domestic market price above the FOB price. The market exchange rate is RWF690/USD, and its economic exchange rate is RWF726.57/USD. The domestic financial price of maize can be calculated as follows:

FOB price of Maize $= \$4{,}060$

Subsidy =10% of FOB
$= 0.10 \times 4{,}060$
$= \$406$

Domestic financial price of maize at the port in foreign currency = FOB + Subsidy
$= 4{,}060 + 406$
$= \$4{,}466$

Domestic Financial price of maize at the port in domestic currency $= Price \times E^m$
$= 4{,}466 \times 690$
$= RWF3{,}081{,}540$

The economic price of the exported maize expressed in foreign currency is given by the FOB price:

Economic price of maize at the port in foreign currency $= FOB\ Price$
$= \$4{,}060$

In the absence of a FEP, the economic price of maize at the port in domestic currency can be estimated as the FOB price multiplied by market exchange rate as shown below:

Economic price of maize at the port in domestic currency before adjusting for FEP $= FOB \times E^m$
$= 4{,}060 \times 690$
$= RWF2{,}801{,}400$

The economic prices calculated above have taken into consideration the export subsidy but have not taken into account the fact that trade taxes and subsidies as well as indirect taxes have a systemic effect on the value of all tradable goods and that this distorts the financial price of foreign exchange. The adjustment required to incorporate the impact of the FEP is shown below:

Economic price of maize at the port in domestic currency after adjusting for FEP $= RWF2{,}801{,}400 \times (1 + FEP)$
$= RWF2{,}801{,}400 \times (1 + 0.053)$
$= RWF2{,}949{,}874.2$

The economic value estimated above can also be calculated directly from the FOB price as follows:

Economic price of maize at the port in domestic currency after adjusting for FEP $= FOB(\$) \times E^m \times (1 + FEP)$
$= \$4{,}060 \times RWF690/\$ \times (1.053)$
$= RWF2{,}949{,}874.2$

or

$= FOB(\$) \times E^e$
$= \$4{,}060 \times RWF726.57/\$$
$= RWF2{,}949{,}874.2$

In the event that we do not know the FOB price, and only know the financial price of a metric ton of maize in domestic currency at the port, we can calculate the economic price as follows:

Economic price of maize at the port in domestic currency after adjusting for FEP	$= [Financial\ Price/(1 + Subsidy)] \times (1 + FEP)$ $= [RWF3{,}081{,}540/(1 + 0.1)] \times (1.053)$ $= RWF2{,}949{,}874.2$

Note that the VAT did not have any impact on the financial or economic prices because exports are zero rated for VAT. In other words, the export will not be subject to VAT and moreover, any VAT paid on the inputs used to produce the exported maize are refunded. In the event that the maize is used domestically and not exported, the financial price will be subject to the VAT.

Example 4: Agricultural Project using Maize (Excluding Seed), an Exportable, as an Input (assuming export subsidy on maize)

In this illustrative example, we are assuming a hypothetical project in Rwanda using maize that would have otherwise been exported. The objective is to determine the economic cost of the maize used. The FOB price at the port is $4,060 (28,000 kilogram at USD0.145/kilogram). Assume that the government of Rwanda provides a 10% subsidy (estimated as a percentage of the FOB price) on maize exports. As explained in the above example, the subsidy would result in an increase in the domestic market price above the FOB price. The market exchange rate is RWF690/USD, and its economic exchange rate is RWF726.57/USD. As the maize is sold domestically and is not exported, it is subject to an 18% VAT. The financial price of maize to the project can be calculated as follows:

FOB price of Maize	$= \$4{,}060$
Subsidy	=10% of FOB $= 0.10 \times 4{,}060$ $= \$406$
Financial price of maize at the port in foreign currency (before VAT)	= FOB + Subsidy $= 4{,}060 + 406$ $= \$4{,}466$
Financial price of maize at the port in domestic currency (before VAT)	$= Price \times E^m$ $= 4{,}466 \times 690$ $= RWF3{,}081{,}540$

Financial price of maize at the port in domestic currency (including VAT)

$$= Price\ before\ VAT \times (1 + VAT)$$
$$= RWF3{,}081{,}540 \times (1 + 0.18)$$
$$= RWF3{,}636{,}217.2$$

Note that an exporter will not receive a subsidy from the government for selling domestically. However, if the exporter does not receive a financial price gross of subsidy when selling domestically, he will not have an incentive to sell domestically at all. Consequently, the financial supply price received by an exporter will be the same whether selling locally or exporting.

The economic price of the exported maize expressed in foreign currency is given by the FOB price:

Economic price of maize at the port in foreign currency

$$= FOB\ Price$$
$$= \$4{,}060$$

Economic price of maize at the port in domestic currency before adjusting for FEP

$$= FOB \times E^m$$
$$= 4{,}060 \times 690$$
$$= RWF2{,}801{,}400$$

By adjusting the economic price calculated above for the impact of the FEP, we arrive at the economic price of maize after adjusting for all distortions:

Economic price of maize at the port in domestic currency after adjusting for FEP

$$= RWF2{,}801{,}400 \times (1 + FEP)$$
$$= RWF2{,}801{,}400 \times (1 + 0.053)$$
$$= RWF2{,}949{,}874.2$$

The economic value per metric ton of maize at the port in domestic currency can also be calculated directly from the FOB price as follows:

Economic price of maize at the port in domestic currency after adjusting for FEP

$$= FOB(\$) \times E^m \times (1 + FEP)$$
$$= \$4{,}060 \times RWF690/\$ \times (1.053)$$
$$= RWF2{,}949{,}874.2$$

or

$$= FOB(\$) \times E^e$$
$$= \$4{,}060 \times RWF726.57/\$$$
$$= RWF2{,}949{,}874.2$$

In the event that we do not know the FOB price, and instead we know the financial price (before VAT) of a metric ton of maize in domestic currency at the port, we can calculate the economic price as follows:

Economic price of maize at the port in domestic currency after adjusting for FEP

$$= [Financial\ Price/(1 + Subsidy)] \times (1 + FEP)$$
$$= [RWF3{,}081{,}540/(1 + 0.1)] \times (1.053)$$
$$= RWF2{,}949{,}874.2$$

Note that the economic price of a ton of maize at the port was the same in the case of a project exporting maize as it was in the case of a project using maize. The economic price of an exportable good measured at the port is the FOB price increased by the amount of the FEP.

5.1.2 Conversion Factors for Tradables

Economic prices account for the real resources consumed or products produced by a project and hence do not include tariffs, taxes, or subsidies as these are merely transfers between consumers, producers and the government all within the same economy. Financial prices are market prices, which incorporate all the tariffs, taxes, and subsidies. We use the conversion factor to convert each of the financial cash flow into the economic cost or benefit in the economic resource statement in the economic appraisal.

For a given good or service, the term CSCF is used in lieu of the general term of conversion factor. The CSCF for a given commodity at the port is the commodity's economic price at the port divided by its financial price at the port. If there are no distortions in the supply or demand markets of a commodity and if the market exchange rate is equal to the economic exchange rate, then the CSCF will simply be 1.0 because the economic and financial prices of that commodity are the same. However, the market for foreign exchange in Rwanda is distorted, the economic value of a unit of foreign exchange is greater than the market exchange rate by approximately 5.3% of the market exchange rate. We use this estimate of the FEP in the calculation of the CSCFs for Rwanda's tradable goods and services.

As the CSCF is the ratio of a good's economic price to its financial price, the value of this ratio will be affected by changes in the financial or economic prices of the good in question. It should be noted that while the financial prices could differ from one case to another, the economic price of an importable good measured at the port will be the same whether a project is producing this good as an import substitute or importing it. Similarly, the economic price of an exportable good measured at the port will be the same whether the project is producing the good for export or using it as an input in production.

For example, an excise tax (duty) or a valued added tax levied on a certain good will create a wedge between the demand price (P^d) and the supply price (P^s) of the good. Consequently, a commodity will have two CSCFs depending on whether the project is buying or producing the commodity in question. If the project is using (buying) the commodity, the relevant financial price to the project will be the demand price and the CSCF will be given the notation $CSCF_{II}$ or $CSCF_{EI}$ depending on whether the demanded good is an importable (importable input, II) or exportable (exportable input, EI) commodity. Alternatively, if the project is producing (selling) the commodity, the relevant financial price would be the supply price and the CSCF will be given the notation $CSCF_{IO}$ or $CSCF_{EO}$, i.e. importable output (IO), exportable output (EO). If the supply price of a commodity is equal to its demand price, then the value of CSCF for inputs will be the

same as CSCF for outputs. Given the way trade distortions are levied in Rwanda on tradable commodities, we show below how the CSCF can be estimated for both importable and exportable commodities in Rwanda.

Importable Commodities

For importable commodities, and assuming the only direct distortions are due to import tariffs and other taxes such as excise and value added taxes, the CSCF measured at the port (i.e., before considering transportation and handling costs) for a project importing a commodity to use as an input (importable input, II) can be calculated as follows:[19]

$$CSCF_{II} = \frac{1+FEP}{1+T_m-k_x+T_e\times(1+T_m-k_x)+VAT\times(1+T_m-k_x+T_e+T_m\times T_e)} \quad (9)$$

where,

- FEP is the foreign exchange premium estimated at 5.3% for Rwanda;
- T_m stands for the rate of import duty levied on the CIF price of the imported input;
- k_x 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; and
- VAT is the value added tax rate levied on the basis of the sum of CIF price, import duty, and excise duty on the commodity.

Commodities that are subject to an excise tax are either subject to a specific tax (e.g., RWF/liter) or an ad valorem tax but not both. In the event that the commodity is subject to an excise tax in ad valorem form, the ad valorem rate will be equal to T_e in equation (9).
In the event that a specific excise duty is used, its ad valorem equivalent as a percentage of the market price of the importable inclusive of import tariffs and international freight and insurance (but excluding VAT) should be estimated and substituted for T_e in equation (9).[20]

In the event that the imported input is not subject to VAT or, alternatively, if the financial price before VAT is used in the determination of the conversion factor, then a value of zero should be substituted for VAT in equation (9).

The CSCF measured at the port (i.e., before considering transportation and handling costs) for a project producing an import substitute (importable output, IO) measured at the port can be calculated as follows:[21]

[19] If in addition to the taxes there are quantitative restrictions (QRs), the tariff equivalent of the quantitative restrictions should be determined. If there are both quantitative and tariff restrictions, the CSCF is estimated as follows: $CSCF_{II}(port) = (1 + FEP)/(1 + QR)$.
[20] According to Official Gazette no 03 of 16/01/2012, excise duties on gas oil and premium (excluding benzene) are subject to specific taxes of 150 RWF/liter and 183 RWF/liter, respectively. For these commodities the specific taxes are converted into ad valorem rates by taking the ratio between the taxes and the market price of the commodities. These rates are used in the CSCF database for the commodities with the HS codes 27.10.12.10, 27.10.12.20, respectively.

$$CSCF_{IO} = \frac{1+FEP}{1+ T_m-k_x+T_e\times(1+T_m-k_x)+VAT\times(1+T_m-k_x+T_e+T_m\times T_e)} \quad (10)$$

Exportable Commodities

For exportable goods, and assuming the only direct distortions levied on the commodity are due to an export subsidy or export tax and a VAT, the CSCF measured at the port (i.e., before considering transportation and handling costs) for a project producing an exportable commodity (exportable output, EO) will be estimated as follows:

$$CSCF_{EO} = \frac{1+FEP}{(1+ k_x-T_x)} \quad (11)$$

where, k_x stands for the rate of export subsidy, and T_x is the rate of export tax, both expressed as the percentage of the FOB price.[22]

The CSCF measured at the port (i.e., before considering transportation and handling costs) for a project using an exportable good as an input (exportable input, EI, i.e., a good that would have otherwise been exported) can be calculated as follows:

$$CSCF_{EI} = \frac{1+FEP}{(1+ k_x-T_x)\times(1+VAT)} \quad (12)$$

The only difference between the conversion factors in equations (11) and (12) is the VAT. If a project is using an exportable input, the financial price to the project will include the VAT. If, on the other hand, a project is producing a good for export, the supply price to this project will not include the VAT.

If the input is not subject to VAT or, alternatively, if the financial price before VAT is used in the determination of the conversion factor, then a value of zero should be substituted for VAT in equation (12).

If a project is exempt from paying the VAT on any of its traded inputs, the financial price of this traded input will be lower than the financial price for the input in a non-exempt case, which will cause the CSCF for the input in the exempt case to be higher.

Examples for Computing the Financial and Economic Prices at the Port

Here we estimate the CSCFs for the four cases addressed above in subsection 5.1.1.

[21] If in addition to the taxes there are quantitative restrictions (QRs), the tariff equivalent of the quantitative restrictions should be determined. If there are both quantitative and tariff restrictions, the CSCF is estimated as follows: $CSCF_{IO}(port) = (1 + FEP)/(1 + QR)$.

[22] As highlighted earlier, exports are zero rated for VAT.

Example 1 (revisited): Irrigation Project Importing "Tubes, Pipes and Hoses, Rigid of Other Plastics"

The CSCF is estimated as the ratio of the economic price to the financial price. In the case of a project importing an input, the relevant financial price to the project would be the demand price, P^d, (the price inclusive of all taxes). The financial price to the project has been estimated to be RWF3,270,030.75 and the economic price to be RWF2,334,469.41. Consequently, the CSCF is estimated as follows:

$$CSCF_{II} = \frac{P^e}{P^d} = \frac{2{,}334{,}469.41}{3{,}270{,}030.75} = 0.7139$$

Alternatively, the CSCF can be estimated using equation (9) as shown below.

$$CSCF_{II} = \frac{1+FEP}{1+T_m-k_m+T_e\times(1+T_m-k_m)+VAT\times(1+T_m-k_m+T_e+T_m\times T_e)}$$
$$= \frac{1.053}{1.25\times(1+0.18)} = 0.7139$$

where T_m is the rate of import duties of 25%, T_e is the rate of excise tax and is equal to zero, VAT is 18%, and the FEP is 5.3%.

Example 2 (revisited): Import Substitution Project Producing "Tubes, Pipes and Hoses, Rigid of Other Plastics" in Rwanda (import subject to tariff)

The CSCF is estimated as the ratio of the economic price to the financial price. In the case of a project producing an import substitute (tubes, pipes and hoses, in this case), the relevant financial price to the project would be the supply price, P^s, (the price received by the project). The financial price to the project has been estimated to be RWF3,270,030.75 and the economic price to be RWF2,334,469.41. Consequently, the CSCF is estimated as follows:

$$CSCF_{IO} = \frac{P^e}{P^d} = \frac{2{,}334{,}469.41}{3{,}270{,}030.75} = 0.7139$$

Alternatively, the CSCF can be estimated using equation (10) as follows:

$$CSCF_{IO} = \frac{1+FEP}{1+T_m-k_m+T_e\times(1+T_m-k_m)+VAT\times(1+T_m-k_m+T_e+T_m\times T_e)}$$
$$= \frac{1.053}{1.25\times(1+0.18)} = 0.7139$$

where T_m is the rate of import duties of 25%, T_e is the rate of excise tax and is equal to zero, VAT is 18%, and the FEP is 5.3%.

As the financial and the economic prices of the project items at the port are the same whether the commodities are being produced (an import substitute) or being used (an import), so are the CSCFs for importable inputs and importable outputs.

Example 3 (revisited): Project to Export Maize (Excluding Seed) from Rwanda (assuming an export subsidy on yarn)

The CSCF is estimated as the ratio of the economic price to the financial price. In the case of a project exporting maize, the relevant financial price to the project would be the supply price, P^s, (the price received by the project). The financial price to the project is RWF3,081,540 and the economic price (after adjusting for FEP) is RWF2,949,874.2. Consequently, the CSCF is estimated as follows:

$$CSCF_{EO} = \frac{P^e}{P^d} = \frac{2{,}949{,}874.2}{3{,}081{,}540} = 0.9573$$

Alternatively, the CSCF can be estimated using equation (11) as follows:

$$CSCF_{EO} = \frac{1+FEP}{(1+ k_x - T_x)} = \frac{1.053}{1.1} = 0.9573$$

where k_x is the subsidy rate of 10%, and the FEP is 5.3%.

Example 4 (revisited): Agricultural Project using Maize (Excluding Seed), an Exportable, as an Input (assuming export subsidy on maize)

The CSCF is estimated as the ratio of the economic price to the financial price. In the case of a project using (purchasing) maize, the relevant financial price to the project would be the demand price, P^d, (the price paid by the project). The financial price to the project (including VAT) is RWF3,636,217.2 and the economic price (after adjusting for FEP) is RWF2,949,874.2. Consequently, the CSCF is estimated as follows:

$$CSCF_{EI} = \frac{P^e}{P^d} = \frac{2{,}949{,}874.2}{3{,}636{,}217.2} = 0.8112$$

Alternatively, the CSCF can be estimated using equation (11) as follows:

$$CSCF_{EI} = \frac{1+FEP}{(1+ k_x - T_x)\times(1+VAT)} = \frac{1.053}{1.1 \times 1.18} = 0.8112$$

Note that while the economic price of a ton of maize at the port is the same whether a project is exporting maize or using it as an input, the financial price is different in the two situations. In the case of a project exporting maize, the VAT is ignored as exports are zero rated for VAT; but in the case of a project using the maize domestically, the maize will be subject to VAT. Consequently, the CSCFs are different in both cases.

5.1.3 Estimating Commodity-Specific Conversion Factors for Tradable Commodities in Rwanda

Two issues regarding the estimation of the CSCFs are discussed in this subsection of the report. While the first issue deals with the fact that each commodity has two CSCFs, the second issue deals with the different import tariff schedules faced by the different groups of countries.

Two CSCFs for Each Commodity

As the CSCF is the ratio of the economic price of a good or service to its financial price, and as the financial price of the same good could vary depending on whether a project is producing the good or using it as an input, each commodity will consequently have two CSCFs. The formulae used for the estimation of the CSCF presented above are reproduced below for convenience.

In the case of an importable input used by a project:

$$CSCF_{II} = \frac{1+FEP}{1+ T_m-k_x+T_e\times(1+T_m-k_x)+VAT\times(1+T_m-k_x+T_e+T_m\times T_e)} \quad (9)$$

In the case of a project producing an import substitute:

$$CSCF_{IO} = \frac{1+FEP}{1+ T_m-k_x+T_e\times(1+T_m-k_x)+VAT\times(1+T_m-k_x+T_e+T_m\times T_e)} \quad (10)$$

In the case of a project producing for export:

$$CSCF_{EO} = \frac{1+FEP}{(1+ k_x-T_x)} \quad (11)$$

In the case of a project using an exportable input (that would have otherwise been exported):

$$CSCF_{EI} = \frac{1+FEP}{(1+ k_x-T_x)\times(1+VAT)} \quad (12)$$

where,

- FEP is the foreign exchange premium estimated at 5.3% for Rwanda;
- T_m stands for the rate of import duty levied on the CIF price of the imported input;
- T_e is the rate of excise duty levied on the CIF price plus the import duty on the imported input;
- VAT is the value added tax rate levied on the basis of the sum of CIF price, import duty, and excise duty on the commodity;
- k_x stands for the rate of export subsidy, and T_x is the rate of export tax, both expressed as the percentage of the FOB price.

In the event that an input is VAT exempt or zero-rated for VAT, then a value of zero should be used for VAT in the above formulae.

Different Tariff Rates for Different Groups of Countries

Given Rwanda's membership to the EAC, and the Common Market for Eastern and Southern Africa (COMESA), there are four schedules of import duties applicable to each commodity depending on the origin of import:

1. 0% tariff rate is applied for commodities with the origin of import from EAC, and the following COMESA countries (named as COMESA A): Burundi, Comoros, Djibouti, Egypt, Kenya, Libya, Madagascar, Malawi, Mauritius, Seychelles, Sudan (North and South), Uganda, Zambia, Zimbabwe;
2. 80% preferential reduction rate is applied for commodities imported from the COMESA member state Eritrea (COMESA B). That is to say, if a commodity with 10% import duty is imported from Eritrea, T_m is replaced with 2% in the calculations of CSCFs for that particular commodity;
3. 10% preferential reduction rate is applied for commodities imported from the COMESA member state Ethiopia (COMESA D). In other words, 9% import duty rate is used in the calculation of CSCF for a commodity imported from Ethiopia with 10% import duty rate.
4. Standard tariff rates are applied for commodities imported from the rest of the world.

If a project is using an imported input from an EAC country or a COMESA A country, then the relevant custom duty rate should be used in equation (9) to arrive at the correct conversion factor. This is shown below for a motor vehicle for the transport of not more than 15 persons (HS 87.02.10.22). The import duty on this good is 0% if it is imported from an EAC country or COMESA A countries, 5% if imported from Eritrea, 22.5% if imported from Ethiopia, and 25% otherwise.

Using equation (9) above, the CSCF measured at the port for this type of motor vehicle will vary depending on the origin of the country exporting to Rwanda as shown below.

- Origin: EAC or COMESA A countries

$$CSCF_{II} = \frac{1+FEP}{1+T_m+T_e\times(1+T_m)+VAT\times(1+T_m+T_e+T_m\times T_e)} = \frac{1.053}{(1+0)+0.18} = 0.8924$$

- Origin: Eritrea

$$CSCF_{II} = \frac{1.053}{(1+0.05)+0.18\times(1+0.05)} = 0.8499$$

- Origin: Rest of the world

$$CSCF_{II} = \frac{1.053}{(1+0.25)+0.18\times(1+0.25)} = 0.7139$$

If a project is producing an output that is substituting for an import that is neither specific nor unique to a certain EAC or COMESA country, then the $CSCF_{IO}$ based on the general rate of custom duty would be appropriate. If alternatively, the project is substituting for a certain import that is indeed specific or unique to a certain EAC or COMESA country, then the relevant custom duty should be used in equation (10) to estimate the appropriate $CSCF_{IO}$.

The current import duty rates in the Rwanda CSCF database are based on the latest import data that present the origins of all imported commodities together with their HS codes. In cases where a particular commodity is imported both from EAC or COMESA member states and from the rest of the world, a 20% rule is applied as follows. If the share of those imports from the rest of the world in the total imports of the particular commodity is observed to be greater than 20%, the standard import duty rate is applied in the calculation of the CSCF for that commodity. The same logic is applied to the other import schedules described earlier.

5.2 Conversion Factors for Non-tradables

This subsection provides a detailed analysis of the estimation of CSCFs for the major non-tradable goods and services for Rwanda. An economic analysis of any projects requires CSCFs for the calculation of economic prices. The CSCFs estimated are required by a wide range of public and private projects. Almost all of the projects use transportation, construction, electricity, and telecommunication as inputs or intermediate products. Therefore, it is important to get the accurate economic prices and conversion factors for these non-tradable goods and services.

This subsection utilizes concepts presented in Section 4 of this report in the estimation of the CSCFs for some of the major non-tradable services in Rwanda. These are transportation, construction, electricity, and telecommunication.

While the markets for these non-tradable services contain distortions in the form of taxes or subsidies that affect the supply and/or demand prices, these markets are nevertheless competitive in the sense that prices are determined by the equilibrium of the forces of demand and the supply. As a result, it is possible to estimate a fairly accurate and representative economic price and a CSCF using national data such as the national input-output tables.

Subsections 5.2.1 through 5.2.2 provide detail estimations of CSCFs for transportation, construction, electricity, and telecommunications.

The results of the analyses are summarized below.

Item	**CSCF**
Transportation	0.8724
Construction	0.8840
Electricity	0.8731
Telecommunication	0.8622

5.2.1 Transportation in Rwanda

There is hardly a project that does not have a transportation component. Based on the analytical framework described in Section 4 of this report, we here present the estimation of CSCF for transportation services in Rwanda.

Cost Structure for Transportation

Table 4 presents the cost structure for transportation services in Rwanda.

Table 4: Cost Structure for Transportation in Rwanda

Products	Annual Cost (Million RWF)	% of Total Cost (%TC)	Share of Tradable Components (%T)	Share of Non-tradable Components (%NT)
Meat & dairy	0.6	0.0%	100%	0%
Sugar & bakery & confectionary	0.0	0.0%	100%	0%
Beverages & tobacco	3.0	0.0%	100%	0%
Other manufactured food	256.8	0.2%	100%	0%
Textile and clothing	4.0	0.0%	100%	0%
Leather & footwear	0.1	0.0%	100%	0%
Wood & paper	0.3	0.0%	100%	0%
Printing and publishing	50.6	0.0%	100%	0%
Petroleum	2,244.2	2.1%	100%	0%
Chemicals	27.0	0.0%	100%	0%
Non metallic products	210.1	0.2%	100%	0%
Other manufactures	9,539.5	8.9%	100%	0%
Water	48.0	0.0%	61%	39%
Electricity	1,661.2	1.5%	73%	27%
Trade	7,364.7	6.9%	52%	48%
Transport	25,933.6	24.2%	32%	68%
Communication	812.7	0.8%	52%	48%
Finance	2,957.2	2.8%	56%	44%
Real estate	476.2	0.4%	50%	50%
Other services	12,039.4	11.2%	58%	42%
Public administration	48.5	0.0%	71%	29%
Skilled labor	4,314.2	4.0%	0%	100%
Semi-skilled labor	15,062.7	14.1%	0%	100%
Unskilled labor	2,387.2	2.2%	0%	100%
Capital	21,761.1	20.3%	100%	0%
Total	**107,202.9**	**100.0%**		

Source: Rwanda Supply and Use Tables 2006, and authors' own calculations.

The largest cost component of the final output transportation is the intermediate good transportation with 24.2% share of the total cost. The second largest cost component is labor with 20.3% share of the total cost.

Distortions in the Transportation Industry

Various distortions affect the truck transportation sector in Rwanda. These distortions result in the financial prices not reflecting the true resource costs of the transport services. Distortions include taxes levied on the service itself, as well as taxes and custom duties on inputs used to provide the transportation services (such as fuel, trucks and labor). In-land transportation services are subject to a 18% VAT. VAT paid on inputs, however, will be credited against future VAT payments by the economic entity using the freight services. So in effect, inputs can be considered VAT-free with the final output being subject to the full brunt of the VAT.[23] If the final output is exempt from VAT, then the inputs will bear the VAT. The convention followed in the estimation of the conversion factors of non-tradables in this report is to apply the CSCF to the financial demand price inclusive of VAT.

Table 5 reports the distortions on the various inputs used in the production of freight services.

For cost components of each input used in the production of transportation services, import tariffs and excise duties were netted from the financial market value of the inputs to derive their economic prices. The adjustment for custom duties on the inputs was based on the import tariff schedules faced by the different groups of countries explained in subsection 5.1.3. These rates are identified according to the HS which gives each commodity a detailed several-digit unique identifier.

Depending on the cost structures of the inputs of the final good of transportation, each input encompasses various HS code categories. The third column of Table 5 presents the (sub)chapters of the HS that are used to calculate the effective rate of distortions for each input item.[24] For some composite inputs, such as trade, an average tariff rate for the different elements of the component is used in the calculations.

[23] To illustrate, suppose a cement project uses a truck company to move the bagged cement. The financial cost paid for the freight service would include the VAT. Consequently, if the cost of freight for a certain shipment of cement was RWF100,000, the project would pay RWF118,000 (price plus VAT). If the price of the shipment (excluding VAT) to the buyer is RWF500,000, the buyer would end up paying a total of RWF590,000 (RWF500,000 for the service and 90,000 in VAT). The project would then credit the VAT payments for transport (and all other inputs) against the VAT it has received on the sale of cement and delivers the balance to the government. Assuming inputs other than transport are subject to a zero VAT, the project would deliver only RWF72,000 (the difference between RWF90,000 and RWF18,000) to the government claiming the VAT that it had paid on the transport service.

[24] That is to say, in order to calculate the effective distortion rates in column two of Table 5, first we calculated the distortions on inputs of the products, i.e. cost of input times the nominal average tax rate of the particular HS (sub)chapters. Then the effective distortion rates are calculated as the share of distortions in the total cost of the products.

Table 5: Distortions in the Markets of Transportation and its Inputs

Products	Import Duty	Excise Duty	HS Distortions
Meat & dairy	7.3%	1.5%	[a]
Sugar & bakery & confectionary	3.7%	1.4%	[b]
Beverages & tobacco	4.5%	3.7%	[c]
Other manufactured food	7.5%	25.4%	Chapters 16-24
Textile and clothing	3.4%	1.2%	Chapters 50-63
Leather & footwear	5.7%	0.9%	[d]
Wood & paper	5.9%	0.0%	Chapter 44
Printing and publishing	6.1%	0.0%	[e]
Petroleum	3.7%	1.4%	Chapter 27
Chemicals	2.9%	1.1%	Chapters 28-38
Non metallic products	0.8%	0.2%	Chapter 28
Other manufactures	7.6%	0.4%	Chapter 96
Water	0.4%	0.1%	Chapter 85
Electricity	1.4%	0.3%	Chapters 27, 84-5
Trade	1.5%	0.2%	[f]
Transport	1.9%	0.1%	Chapters 86-9
Communication	1.7%	0.1%	Subchapter 85.17
Finance	0.6%	0.0%	[f]
Real estate	0.3%	0.0%	[f]
Other services	1.4%	0.7%	[f]
Public administration	2.6%	0.2%	[f]

[a] Chapters 2, 4, 16, ; Subchapter 84.34; Commodities 84.18.61.10, 84.18.69.10, 84.38.50.00.
[b] Chapter 17, Commodities 12.09.10.00, 12.12.91.00, 12.12.93.00, 18.06.10.00, 29.40.00.00, 84.17.20.00, 84.38.10.00, 84.38.30.00.
[c] Chapter 22; Subchapters 33.02, 84.35; Commodities 21.06.90.20, 73.10.29.20, 76.12.90.10, 84.21.22.00, 84.22.30.00.
[d] Chapters 41-3, 64-7; Subchapters 32.10, 34.03, 38.09, 83.08, 84.53; Commodities 3405.10.00, 6812.91.00.
[e] Subchapter 32.15, 48.02, 48.10; Chapter 49, 84.42, 84.43; Commodity 9006.10.00.
[f] Average of effective distortions on the components of the industry.

Estimation of Commodity-Specific Conversion Factor for Transportation

To estimate the CSCF for transportation services in Rwanda we used the general formula in equation (5), Section 4 of this report. In order to calculate the CSCF for transportation by using equation (5), we need to estimate the total distortions on tradable and distortions on non-tradable inputs. Table 6 contains this information.

Table 6: Distortions on Tradable and Non-tradable Inputs of Transportation Services

Products	Total Distortions on Tradable Inputs (Million RWF)	Total Distortions on Non-tradable Inputs
Meat & dairy	0.05	
Sugar & bakery & confectionary	0.00	
Beverages & tobacco	0.23	
Other manufactured food	66.20	
Textile and clothing	0.18	
Leather & footwear	0.00	
Wood & paper	0.02	
Printing and publishing	2.92	
Petroleum	111.42	
Chemicals	1.04	
Non metallic products	2.11	
Other manufactures	706.84	
Water		-0.82
Electricity		-17.56
Trade		-96.81
Transport		-384.18
Communication		-10.55
Finance		-49.89
Real estate		-8.57
Other services		-127.31
Public administration		-0.28
Skilled labor		86.28
Semi-skilled labor		3,012.54
Unskilled labor		954.88
Total	**891.01**	**3,357.74**

As explained in Section 4, in addition to the distortions in the market for the inputs used in a non-tradable good or service, i.e., transportation in this case, the estimation of economic prices of non-tradable goods and services requires adjustments for distortions in the market for the good or service itself. Furthermore, the distortions in the market where demand is being diverted towards or away from need to be accounted for. The final correction is for the FEP and NTP on tradable and non-tradable components of the non-tradable good or service. Table 7 presents these adjustments and estimation of the economic price, P^e, and CSCF for transportation services in Rwanda.

Table 7: Estimation of Commodity-Specific Conversion Factor for Transportation Services in Rwanda

$P_x^{\,e} = W_x^{\,s} P_x^{\,m}(1 + k_x) + W_x^{\,d} P_x^{\,m}(1 + t_x^{\,v} - d^*)$ (5) $-W_x^{\,s}[\sum_i a_{ix}^o P_i^{\,m} d_i + \sum_j a_{jx}^o \{W_j^{\,s} P_j^{\,m}(t_j^{\,e} + g_j - k_j) + W_j^{\,d} P_j^{\,m}(d^* - t_j^{\,v})\}]$ $+[P_x^{\,m} \times T_x \times FEP] + [P_x^{\,m} \times NT_x \times NTP]$
(1) $W_x^{\,s} P_x^{\,m}(1 + k_x) + W_x^{\,d} P_x^{\,m}(1 + t_x^{\,v} - d^*) = 67\% \times 107{,}202.9 \times (1 + 0\%)$ $+33\% \times 107{,}202.9 \times (1 + 18\% - 12.3\%) = 109{,}239.8$ (million RWF)
(2) $- W_x^{\,s}\left[\sum_i a_{ix}^o P_i^{\,m} d_i + \sum_j a_{jx}^o \left\{W_j^{\,s} P_j^{\,m} d_j + W_j^{\,d} P_j^{\,m}\left(d^* - t_j^{\,v}\right)\right\}\right]$ $= -67\% \times [891.01 + 3{,}357.74] = -2{,}832.5$ (million RWF)
(3)$+[P_x^{\,m} \times T_x \times FEP] + [P_x^{\,m} \times NT_x \times NTP] = 107{,}202.9 \times 62.0\% \times 5.3\%$ $+107{,}202.9 \times 38\% \times 1.05\% = 3{,}949.6$ (million RWF)
Economic Value $(P^e) = (1) + (2) + (3) = 109{,}239.8 - 2{,}832.5 + 3{,}949.6$ $= 110{,}356.9$ (million RWF)
Financial Value $(P^d) = P_x^{\,m} \times (1 + VAT) = 107{,}202.9 \times 1.18 = 126{,}499.5$ (million RWF)
CSCF for Construction $= P^e / P^d = 110{,}356.9 / 126{,}499.5 = 0.8724$

Considering the nature of the market of non-tradable goods and services in Rwanda, it is reasonable to expect that the responsiveness of suppliers of transportation services to changes in service prices is twice that of the demanders of these services, i.e. $W_s^{\,x} = 2/3, W_x^{\,d} = 1/3$.

About 62% of the total cost of transportation that is made up of tradable inputs was adjusted for the FEP. The non-tradable content subject to the premium on non-tradable outlays was estimated to be 38%. The tradable and non-tradable good components of the transportation services is expressed as a percentage of the total cost of transportation or the financial market price of the output of this sector.

As presented in Table 7, we obtain an estimate of the CSCF for transportation services in Rwanda equal to 0.8724. Tables 4-7 provide all the necessary data for the estimation of the conversion factor for construction.

5.2.2 Construction Services in Rwanda

In order to calculate the CSCF for construction services in Rwanda, first the economic price of construction is calculated using the cost structure for and distortions in the construction industry.

Cost Structure for Construction

The cost structure for construction services in Rwanda is presented in Table 8.

Table 8: Cost Structure for Construction Services in Rwanda

Products	Annual Cost (Million RWF)	% of Total Cost (%TC)	Share of Tradable Components (%T)	Share of Non-tradable Components (%NT)
Mining	72.5	0.0%	100%	0%
Textile and clothing	108.2	0.1%	100%	0%
Wood & paper	2,694.1	1.4%	100%	0%
Printing and publishing	686.0	0.4%	100%	0%
Petroleum	42,985.0	22.0%	100%	0%
Chemicals	1,370.9	0.7%	100%	0%
Metals and machines	28,170.8	14.4%	100%	0%
Non metallic products	34,519.8	17.7%	100%	0%
Other manufactures	7,984.9	4.1%	100%	0%
Water	145.1	0.1%	61%	39%
Electricity	288.9	0.1%	73%	27%
Construction	2,558.6	1.3%	86%	14%
Trade	3,558.5	1.8%	52%	48%
Hotels	576.6	0.3%	42%	58%
Transport	1,800.1	0.9%	32%	68%
Communication	397.1	0.2%	52%	48%
Finance	5,243.2	2.7%	56%	44%
Other services	397.1	0.2%	58%	42%
Skilled labor	922.6	0.5%	0.0%	100%
Semi-skilled labor	9,182.2	4.7%	0.0%	100%
Unskilled labor	1,561.1	0.8%	0.0%	100%
Capital	49,953.4	25.6%	100.0%	0%
Total	**195,176.9**	**100.0%**		

Source: Rwanda Supply and Use Tables 2006, and authors' own calculations.

Table 8 shows that the largest intermediate cost component in the production of the final output "construction" is petroleum. The second and third largest components of total cost accounting for 17.7% and 14.4% of the total cost are non-metallic products (cement, ceramics, glass, lime etc.) and metals and machines, respectively.

The supply and use tables have a line item "capital" or "gross operating surplus". This is comprised of return to capital and recovery of depreciation of capital goods used in construction (such as bulldozers, cement mixers and trucks).

Distortions in the Construction Industry

Several distortions exist in the construction industry in Rwanda. Distortions include taxes levied on the service itself, as well as taxes and custom duties on inputs used to provide the construction services (such as cement, trucks and labor). Construction services are subject to a

18% VAT. VAT paid on construction services, however, may be credited or offset against future VAT payments by the economic entity buying the construction services, if the final product in which construction is an input is subject to VAT. In the event that the final product is not subject to VAT, all intermediate inputs including construction will bear the VAT. Table 9 reports different distortions on the inputs for construction services.

Table 9: Distortions in the Markets of Construction and its Inputs

Products	Effective Import Duty Rate	Effective Excise Duty Rate	HS Chapters
Mining	2.2%	0.3%	Chapters 25-7
Textile and clothing	3.4%	1.2%	Chapters 50-63
Wood & paper	5.9%	0.0%	Chapter 44
Printing and publishing	6.1%	0.0%	[a]
Petroleum	3.7%	1.4%	Chapter 27
Chemicals	2.9%	1.1%	Chapters 28-38
Metals and machines	4.6%	0.0%	Chapters 72-85
Non metallic products	0.8%	0.2%	Chapter 28
Other manufactures	7.6%	0.4%	Chapter 96
Water	0.4%	0.1%	Chapter 85
Electricity	1.4%	0.3%	Chapters 27, 84-5
Construction	2.9%	0.3%	Chapters 68-70, 73
Trade	1.5%	0.2%	[b]
Hotels	3.1%	3.5%	[b]
Transport	1.9%	0.1%	Chapters 86-9
Communication	1.7%	0.1%	Subchapter 85.17
Finance	0.6%	0.0%	[b]
Other services	1.4%	0.7%	[b]

[a] Subchapter 32.15, 48.02, 48.10; Chapter 49, 84.42, 84.43; Commodity 9006.10.00.
[b] Average of effective distortions on the components of the industry.

To arrive at the economic cost of the tradable components of each input used in the construction industry, custom duties were netted from the financial (demand) value of the inputs to derive their economic prices. The adjustment for custom duties on the inputs was based on the import tariff schedules faced by the different groups of countries explained in subsection 5.1.3. The third column of Table 9 presents the (sub)chapters of the HS that are used to calculate the effective rate of distortions for each input item.[25] For some composite inputs, such as trade, an average tariff rate for the different elements of the component is used in the calculations.

[25] That is to say, in order to calculate the effective distortion rates in column two of Table 9, first we calculated the distortions on inputs of the products, i.e. cost of input times the nominal average tax rate of the particular HS (sub)chapters. Then the effective distortion rates are calculated as the share of distortions in the total cost of the products.

Labor, another component in the construction industry, is subject to various distortions. These labor market distortions have been accounted for in the assumptions made for the conversion factors of labor.[26] We use the conversion factor of 0.98 for skilled labor, 0.80 for semi-skilled labor, and 0.60 for unskilled labor to adjust the financial prices for distortions in the labor market and to estimate the true economic cost of labor. These assumptions depend on the analytical framework of the estimation of economic opportunity cost of labor described in Jenkins et al. (2011b).[27]

Estimation of Commodity-Specific Conversion Factor for Construction

To estimate the CSCF for construction services in Rwanda we used the general formula in equation (5), Section 4 of the report. In order to calculate the CSCF for construction by using equation (5), we need to estimate the total distortions on tradable and distortions on non-tradable inputs. Table 10 contains this information.

Table 10: Distortions on Tradable and Non-tradable Inputs of Construction Services

Products	Total Distortions on Tradable Inputs (Million RWF)	Total Distortions on Non-tradable Inputs (Million RWF)
Mining	1.77	
Textile and clothing	4.71	
Wood & paper	149.55	
Printing and publishing	39.57	
Petroleum	2,134.08	
Chemicals	52.91	
Metals and machines	1,245.29	
Non metallic products	346.99	
Other manufactures	591.65	
Water		-2.48
Electricity		-3.05
Construction		-1.51
Trade		-46.78
Hotels		-0.29
Transport		-26.67
Communication		-5.15
Finance		-88.46
Other services		-4.20
Skilled labor		18.45
Semi-skilled labor		1,836.44

[26] Due to significant informal sector and lack of detailed labor statistics in Rwanda, economic opportunity cost of labor could not be estimated empirically.

[27] The same conversion factors are used for the labor inputs of transportation, electricity, and telecommunication services.

Unskilled labor		624.43
Total	**4,566.52**	**2,300.73**

When the adjustments explained earlier are done for the input and output markets of construction services, we obtain an estimate of the CSCF for this industry equal to 0.8840. Table 11 presents the components of the estimation of the economic price and the CSCF for construction in Rwanda.

Table 11: Estimation of Commodity-Specific Conversion Factor for Construction Services in Rwanda

$P_x^{\,e} = W_x^{\,s} P_x^{\,m}(1+k_x) + W_x^{\,d} P_x^{\,m}(1+t_x^{\,v}-d^*)$ (5) $-W_x^{\,s}[\sum_i a_{ix}^o P_i^{\,m} d_i + \sum_j a_{jx}^o \{W_j^{\,s} P_j^{\,m}(t_j^{\,e}+g_j-k_j) + W_j^{\,d} P_j^{\,m}(d^*-t_j^{\,v})\}]$ $+[P_x^{\,m} \times T_x \times FEP] + [P_x^{\,m} \times NT_x \times NTP]$
(1) $W_x^{\,s} P_x^{\,m}(1+k_x) + W_x^{\,d} P_x^{\,m}(1+t_x^{\,v}-d^*) = 67\% \times 195{,}176.9 \times (1+0\%)$ $+33\% \times 195{,}176.9 \times (1+18\%-12.3\%) = 198{,}885.2$ (million RWF)
(2) $-W_x^{\,s}\left[\sum_i a_{ix}^o P_i^{\,m} d_i + \sum_j a_{jx}^o \left\{W_j^{\,s} P_j^{\,m} d_j + W_j^{\,d} P_j^{\,m}(d^*-t_j^{\,v})\right\}\right]$ $= -67\% \times [4{,}566.52 + 2{,}300.73] = -4{,}578.2$ (million RWF)
(3)$+[P_x^{\,m} \times T_x \times FEP] + [P_x^{\,m} \times NT_x \times NTP] = 195{,}176.9 \times 87.2\% \times 5.3\%$ $+195{,}176.9 \times 12.8\% \times 1.05\% = 9{,}279.6$ (million RWF)
Economic Value $(P^e) = (1)+(2)+(3) = 198{,}885.2 - 4{,}578.2 + 9{,}279.6$ $= 203{,}586.6$ (million RWF)
Financial Value $(P^d) = P_x^{\,m} \times (1+VAT) = 195{,}176.9 \times 1.18 = 203{,}341.3$ (million RWF)
CSCF for Construction $= P^e/P^d = 203{,}586.6\,/230{,}308.7 = 0.8840$

5.2.3 Electricity in Rwanda

Similar to contraction services, CSCF for electricity is estimated according to equation (5) and required adjustments in the input and output markets of the industry.

Cost Structure for Electricity

Table 12 presents the cost structure for electricity generation in Rwanda.

Table 12: Cost Structure for Electricity in Rwanda

Products	Annual Cost (Million RWF)	% of Total Cost (%TC)	Share of Tradable Components (%T)	Share of Non-tradable Components (%NT)
Wood & paper	7.43	0.0%	100%	0%
Printing and publishing	118.818	0.7%	100%	0%
Petroleum	3,210.4	19.5%	100%	0%
Metals and machines	638.0	3.9%	100%	0%
Non metallic products	37.1	0.2%	100%	0%
Other manufactures	326.5	2.0%	100%	0%
Water	7.4	0.0%	61%	39%
Electricity	266.4	1.6%	73%	27%
Trade	133.4	0.8%	52%	48%
Hotels	74.2	0.5%	42%	58%
Transport	74.3	0.5%	32%	68%
Communication	155.8	0.9%	52%	48%
Finance	651.8	4.0%	56%	44%
Other services	81.7	0.5%	58%	42%
Skilled labor	78.2	0.5%	0%	100%
Semi-skilled labor	2,710.5	16.5%	0%	100%
Unskilled labor	161.0	1.0%	0%	100%
Capital	7,706.3	46.9%	100%	0%
Total	**16,439.4**	**100.0%**		

Source: Rwanda Supply and Use Tables 2006, and authors' own calculations.

The two main cost components of electricity in Rwanda are petroleum and semi-skilled labor accounting for 19.5% and 16.5% of total cost, respectively. Gross operating surplus represents about 47% of the total cost.

Distortions in the Electricity Industry

Distortions exist in the markets of electricity and its inputs in Rwanda. These distortions include the 18% VAT levied on the sale of electricity as well as taxes and custom duties on inputs used (such as materials and labor) in the production of electricity. VAT paid on purchases of electricity, however, may be credited or offset against future VAT payments by the economic entity buying the electricity if the final product in which the electricity is an input is subject to VAT. In the event that the final product is not subject to VAT, all inputs used in the production of the final output including electricity will bear VAT. Table 13 reports the different distortions on the inputs used in the production of electricity.

Table 13: Distortions in the Markets of Electricity and its Inputs

Products	Import Duty	Excise Duty	HS Distortions
Wood & paper	5.9%	0.0%	Chapter 44
Printing and publishing	6.1%	0.0%	[a]
Petroleum	3.7%	1.4%	Chapter 27
Metals and machines	4.6%	0.0%	Chapters 72-85
Non metallic products	0.8%	0.2%	Chapter 28
Other manufactures	7.6%	0.4%	Chapter 96
Water	0.4%	0.1%	Chapter 85
Electricity	1.4%	0.3%	Chapters 27, 84-5
Trade	1.5%	0.2%	[b]
Hotels	3.1%	3.5%	[b]
Transport	1.9%	0.1%	Chapters 86-9
Communication	1.7%	0.1%	Subchapter 85.17
Finance	0.6%	0.0%	[b]
Other services	1.4%	0.7%	[b]

[a] Subchapter 32.15, 48.02, 48.10; Chapter 49, 84.42, 84.43; Commodity 9006.10.00.
[b] Average of effective distortions on the components of the industry.

The share of tradable inputs to total cost of electricity was estimated to be 26.4%. This was largely due to the use of petroleum. The total tradable content is adjusted upward by the general FEP of 5.3%.

To arrive at the economic cost of the tradable components of each input used in the production of electricity, import tariffs were netted from the financial (demand) value of the inputs to derive their economic prices. The adjustment for custom duties on the inputs was based on the import tariff schedules faced by the different groups of countries explained in subsection 5.1.3. The third column of Table 13 presents the (sub)chapters of the HS that are used to calculate the effective rate of distortions for each input item.[28] For some composite inputs, such as trade, an average tariff rate for the different elements of the component is used in the calculations.

The non-tradable component of the total cost is about 26.7%. This is subject to the premium on non-tradable outlays adjustment that is estimated to be 1.05% for Rwanda. Labor is a major cost component in the production of electricity. Labor markets are subject to various distortions that require adjustment to arrive at the economic cost of labor. The conversion factors of 0.60, 0.80, and 0.98 are used for unskilled, semi-skilled, and skilled labor, respectively.

[28] That is to say, in order to calculate the effective distortion rates in column two of Table 13, first we calculated the distortions on inputs of the products, i.e. cost of input times the nominal average tax rate of the particular HS (sub)chapters. Then the effective distortion rates are calculated as the share of distortions in the total cost of the products.

Estimation of Commodity-Specific Conversion Factor for Electricity

We again use equation (5) to calculate the CSCF of electricity. First, estimates are made for the distortions on tradable and non-tradable inputs. Table 14 shows the calculation of these items.

Table 14: Distortions on Tradable and Non-tradable Inputs of Electricity Services

Products	Total Distortions on Tradable Inputs (Million RWF)	Total Distortions on Non-tradable Inputs (Million RWF)
Wood & paper	0.41	
Printing and publishing	6.85	
Petroleum	159.38	
Metals and machines	28.20	
Non metallic products	0.37	
Other manufactures	24.19	
Water		-0.13
Electricity		-2.82
Trade		-1.75
Hotels		-0.04
Transport		-1.10
Communication		-2.02
Finance		-11.00
Other services		-0.86
Skilled labor		1.56
Semi-skilled labor		542.10
Unskilled labor		64.42
Total	**219.42**	**588.36**

When the adjustments explained earlier are done for the input and output markets of electricity, we obtain an estimate of the CSCF for this industry equal to 0.8731. Table 15 presents the components of the estimation of the economic price and the CSCF for electricity in Rwanda.

Table 15: Estimation of Commodity-Specific Conversion Factor for Electricity in Rwanda

$$P_x^{\,e} = W_x^{\,s} P_x^{\,m}(1+k_x) + W_x^{\,d} P_x^{\,m}(1+t_x^{\,v}-d^*) \quad (5)$$
$$-W_x^{\,s}[\textstyle\sum_i a_{ix}^o P_i^{\,m} d_i + \sum_j a_{jx}^o \{W_j^{\,s} P_j^{\,m}(t_j^{\,e}+g_j-k_j) + W_j^{\,d} P_j^{\,m}(d^*-t_j^{\,v})\}]$$
$$+[P_x^{\,m} \times T_x \times FEP] + [P_x^{\,m} \times NT_x \times NTP]$$

(1) $W_x^{\,s} P_x^{\,m}(1+k_x) + W_x^{\,d} P_x^{\,m}(1+t_x^{\,v}-d^*) = 67\% \times 16{,}439.4 \times (1+0\%)$
$+33\% \times 16{,}439.4 \times (1+18\%-12.3\%) = 16{,}751.7$ (million RWF)

(2) $-W_x{}^s\left[\sum_i a_{ix}^o P_i{}^m d_i + \sum_j a_{jx}^o \left\{W_j{}^s P_j{}^m d_j + W_j{}^d P_j{}^m \left(d^* - t_j{}^v\right)\right\}\right]$ $= -67\% \times [219.42 + 588.36] = -538.5$ (million RWF)
(3)$+[P_x{}^m \times T_x \times FEP] + [P_x{}^m \times NT_x \times NTP] = 16{,}439.4 \times 78.8\% \times 5.3\%$ $+ 16{,}439.4 \times 21.2\% \times 1.05\% = 723.4$ (million RWF)
Economic Value $(P^e) = (1) + (2) + (3) = 16{,}751.7 - 538.5 + 723.4$ $= 16{,}936.6$ (million RWF)
Financial Value $(P^d) = P_x{}^m \times (1 + VAT) = 16{,}439.4 \times 1.18 = 19{,}398.5$ (million RWF)
CSCF for Electricity $= P^e/P^d = 16{,}936.6/19{,}398.5 = 0.8731$

5.2.4 Telecommunication in Rwanda

Cost Structure for Telecommunication

Table 16 presents the cost structure for telecommunication services in Rwanda.

Table 16: Cost Structure for Telecommunication in Rwanda

Product	Annual Cost (Million RWF)	% of Total Cost (%TC)	Share of Tradable Components (%T)	Share of Non-tradable Components (%NT)
Meat & dairy	0.7	0.0%	100%	0%
Sugar & bakery & confectionary	1.5	0.0%	100%	0%
Beverages & tobacco	0.2	0.0%	100%	0%
Other manufactured food	0.1	0.0%	100%	0%
Textile and clothing	153.9	0.4%	100%	0%
Wood & paper	10.0	0.0%	100%	0%
Printing and publishing	892.9	2.1%	100%	0%
Petroleum	1,914.3	4.5%	100%	0%
Chemicals	0.9	0.0%	100%	0%
Non metallic products	0.3	0.0%	100%	0%
Other manufactures	2,682.7	6.2%	100%	0%
Water	212.9	0.5%	60.9%	39%
Electricity	1,444.5	3.4%	73.3%	27%
Trade	603.8	1.4%	52.1%	48%
Transport	1,097.4	2.6%	31.8%	68%
Communication	2,145.6	5.0%	51.8%	48%
Finance	1,557.5	3.6%	56.3%	44%
Real estate	1,568.5	3.6%	50.3%	50%
Other services	2,292.6	5.3%	58.1%	42%
Skilled labor	985.5	2.3%	0.0%	100%

Semi-skilled labor	5,194.9	12.1%	0.0%	100%
Unskilled labor	3,618.9	8.4%	0.0%	100%
Capital	16,597.1	38.6%	100.0%	0%
Total	**42,976.8**	**100.0%**		

Source: Rwanda Supply and Use Tables 2006, and authors' own calculations.

The largest cost component of telecommunications services in Rwanda is labor accounting for 22.8% of total cost. Gross operating surplus accounts for 38.6% of the total cost.

Distortions in the Telecommunications Industry

Various distortions exist in the markets of telecommunications in Rwanda. These distortions result in the financial prices not reflecting the true resource costs of telecommunications services. Distortions include taxes levied on the service itself, as well as taxes and custom duties on inputs used to provide these services (such as equipment and labor). Telecommunications services are subject to a 18% VAT. VAT paid on these services, however, will be credited against future VAT payments by the economic entity buying the services if the final product in which telecommunications services is an input is subject to VAT. In the event that the final product is not subject to VAT, all inputs used in the production of the final output including telecommunications will bear the VAT. Table 17 reports the different distortions on the inputs used in the production of telecommunications services.

Table 17: Distortions in the Markets of Telecommunications and its Inputs

Products	Import Duty	Excise Duty	HS Distortions
Meat & dairy	7.3%	1.5%	[a]
Sugar & bakery & confectionary	3.7%	1.4%	[b]
Beverages & tobacco	4.5%	3.7%	[c]
Other manufactured food	7.5%	25.4%	Chapters 16-24
Textile and clothing	3.4%	1.2%	Chapters 50-63
Wood & paper	5.9%	0.0%	Chapter 44
Printing and publishing	6.1%	0.0%	[d]
Petroleum	3.7%	1.4%	Chapter 27
Chemicals	2.9%	1.1%	Chapters 28-38
Non metallic products	0.8%	0.2%	Chapter 28
Other manufactures	7.6%	0.4%	Chapter 96
Water	0.4%	0.1%	Chapter 85
Electricity	1.4%	0.3%	Chapters 27, 84-5
Trade	1.5%	0.2%	[e]
Transport	1.9%	0.1%	Chapters 86-9
Communication	1.7%	0.1%	Subchapter 85.17
Finance	0.6%	0.0%	[e]
Real estate	0.3%	0.0%	[e]
Other services	1.4%	0.7%	[e]

[a] Chapters 2, 4, 16, ; Subchapter 84.34; Commodities 84.18.61.10, 84.18.69.10, 84.38.50.00.
[b] Chapter 17, Commodities 12.09.10.00, 12.12.91.00, 12.12.93.00, 18.06.10.00, 29.40.00.00, 84.17.20.00, 84.38.10.00, 84.38.30.00.
[c] Chapter 22; Subchapters 33.02, 84.35; Commodities 21.06.90.20, 73.10.29.20, 76.12.90.10, 84.21.22.00, 84.22.30.00.
[d] Subchapter 32.15, 48.02, 48.10; Chapter 49, 84.42, 84.43; Commodity 9006.10.00.
[e] Average of effective distortions on the components of the industry.

For the tradable cost components of each input used to produce telecommunications services, the import tariffs and excise duties were netted from the financial value of the inputs to derive their economic prices. The adjustment for custom duties on the inputs was based on the import tariff schedules faced by the different groups of countries explained in subsection 5.1.3. The third column of Table 17 presents the (sub)chapters of the HS that are used to calculate the effective rate of distortions for each input item.[29] For some composite inputs, such as trade, an average tariff rate for the different elements of the component is used in the calculations.

Estimation of Commodity-Specific Conversion Factor for Telecommunication

In order to calculate the CSCF for electricity by using equation (5), the distortions on tradable items and distortions on non-tradable items need first to be estimated. Table 18 presents these distortions for the telecommunications industry.

Table 18: Distortions on Tradable and Non-tradable Inputs of Electricity Services

Products	Total Distortions on Tradable Inputs (Million RWF)	Total Distortions on Non-tradable Inputs (Million RWF)
Meat & dairy	0.06	
Sugar & bakery & confectionary	0.07	
Beverages & tobacco	0.01	
Other manufactured food	0.02	
Textile and clothing	6.71	
Wood & paper	0.55	
Printing and publishing	51.51	
Petroleum	95.04	
Chemicals	0.03	
Non metallic products	0.00	
Other manufactures	198.78	
Water		-3.65
Electricity		-15.27
Trade		-7.94
Transport		-16.26

[29] That is to say, in order to calculate the effective distortion rates in column two of Table 17, first we calculated the distortions on inputs of the products, i.e. cost of input times the nominal average tax rate of the particular HS (sub)chapters. Then the effective distortion rates are calculated as the share of distortions in the total cost of the products.

Communication		-27.85
Finance		-26.28
Real estate		-28.23
Other services		-24.24
Skilled labor		19.71
Semi-skilled labor		1,038.98
Unskilled labor		1,447.56
Total	**352.79**	**2,356.54**

The adjustments required for the calculation economic price and CSCF for telecommunication services suggest an estimate of CSCF for the industry equal to 0.8622. Table 19 presents the components of the estimation of the economic price and the CSCF for telecommunication services in Rwanda.

Table 19: Estimation of Commodity-Specific Conversion Factor for Telecommunication in Rwanda

$P_x{}^e = W_x{}^s P_x{}^m(1+k_x) + W_x{}^d P_x{}^m(1+t_x{}^v - d^*)$ (5) $-W_x{}^s[\sum_i a_{ix}^o P_i{}^m d_i + \sum_j a_{jx}^o \{W_j{}^s P_j{}^m(t_j{}^e + g_j - k_j) + W_j{}^d P_j{}^m(d^* - t_j{}^v)\}]$ $+[P_x{}^m \times T_x \times FEP] + [P_x{}^m \times NT_x \times NTP]$
(1) $W_x{}^s P_x{}^m(1+k_x) + W_x{}^d P_x{}^m(1+t_x{}^v - d^*) = 67\% \times 42{,}976.8 \times (1+0\%)$ $+33\% \times 42{,}976.8 \times (1+18\% - 12.3\%) = 43{,}793.3$ (million RWF)
(2) $-W_x{}^s\left[\sum_i a_{ix}^o P_i{}^m d_i + \sum_j a_{jx}^o \left\{W_j{}^s P_j{}^m d_j + W_j{}^d P_j{}^m\left(d^* - t_j{}^v\right)\right\}\right]$ $= -67\% \times [352.79 + 2{,}356.54] = -1{,}806.2$ (million RWF)
(3)$+[P_x{}^m \times T_x \times FEP] + [P_x{}^m \times NT_x \times NTP] = 42{,}976.8 \times 70.4\% \times 5.3\% +$ $42{,}976.8 \times 29.6\% \times 1.05\% = 1{,}737.8$ (million RWF)
Economic Value $(P^e) = (1) + (2) + (3) = 43{,}793.3 - 1{,}806.2 + 1{,}737.8$ $= 43{,}724.9$ (million RWF)
Financial Value $(P^d) = P_x{}^m \times (1+VAT) = 42{,}976.8 \times 1.18 = 50{,}712.6$ (million RWF)
CSCF for Electricity $= P^e/P^d = 43{,}724.9/50{,}712.6 = 0.8622$

6. Use of Conversion Factors in Project Appraisal

6.1 Conversion of Financial Cash Flows into Economic Resource Flow Statements

In project appraisal, the difference between the financial and economic values of inputs and outputs should be emphasized particularly when distortions exist on either the demand or supply side of markets for these goods and services. These distortions, which are caused by trade taxes and subsidies as well as other indirect taxes (such as the value added tax-VAT), drive a wedge between financial and economic prices of goods and services. The concept of a conversion factor, defined as the ratio of the economic price to the financial price, can play an important role in determining the economic costs or benefits of a project and in measuring the divergence between the prices.

Since a CSCF is the ratio of the economic price of a commodity to its financial price, the economic price of any commodity can be determined by multiplying the CSCF of that commodity by its financial price. Rwanda CSCF helps the user identify the CSCF that is then used to estimate the economic price of the commodity as part of the economic appraisal of the investment under analysis.

$$\text{CSCF} = \frac{\text{Economic Price}}{\text{Financial Price}}$$

$$\Downarrow$$

$$\text{Economic Price (real)} = \text{Financial Price (real)}\ x\ \text{CSCF}$$

The estimated conversion factors are multiplied by the real financial cash flows in the total investment cash flow statement in order to derive the economic resource flow statement. The difference between the real economic resource flow statement and the real cash flow statement, i.e. economic minus financial, will produce the statement of economic externalities of the project.

6.2 Conversion Factor for Land and Working Capital Components

There are a few project items for which a CSCF is not presented in the Rwanda CSCF database. These items are land and the working capital components. In this subsection, we briefly explain these project items together with their suggested conversion factors.

6.2.1 Land

Land has an opportunity cost like every other asset when it is used by a project. Even if the land is donated to the project by the government, it should be included as part of the investment cost, at a value that reflects the market value of land in the project area.

Land is a very special asset because it does not depreciate most situations. However, due to improvements in infrastructure, the value of land being used by a project may increase much faster than inflation during the life of the project. In such cases, it is important not to include the increase in land value that is above inflation as part of the liquidation value of the project. In

most cases, the increase in the liquidation value of land (particularly in urban areas) has nothing to do with the project under evaluation. Real increases in land value usually come about because of investment being made in public sector infrastructure. It is important not to attribute the increase in the real value of land to any particular project to avoid introducing a bias toward land-intensive projects. The only exception to this rule occurs when the project either improves or causes damage to the land. In such cases, the amount of the land improvement or deterioration should be added to or subtracted from the real value of the land measured at the beginning of the project to determine the liquidation value of the land at the end of the project.

Alternatively, the opportunity cost of land can be reflected in the cash flow profile of the project by an annual rental charge. This rental charge can be estimated by using the rental rate per dollar value of the land times the real value of the land for each period of the project's life. If the annual rental charge approach is used, then neither the initial cost of the land nor its final market value should enter into the cash flow profile of the project.

Land is a pure non-tradable. It is assumed that there are no distortions exist in that market. The conversion factor for land would, therefore, be equal to 1 (one).

6.2.2 Working Capital

In order to carry out an economic activity, a certain amount of investment has to be made in items that facilitate the conduct of transactions. These items are working capital, including cash, accounts receivable, accounts payable, prepaid expenses, and inventories.

Cash Receipts

A project's viability is not only determined by the sales it generates but also by the timing of the cash receipts from the sales. A cash flow statement records sales transactions only when the cash from the transaction is received. Typically, projects forecast their sales as a single line item, which comprises both credit and cash transactions.

A distinction must be made between sales and cash receipts. When a project makes a sale, the good or service may be delivered to the customer, but no money is transferred from the customer to the project. At this point, the project's accountants will record that the project has an asset called accounts receivable equal to the amount of the sale and the proportion of it that is not in cash. In other words, the buyer owes the project for the goods or services that he has purchased and not yet paid for. Until the buyer has paid for what he has received, the transaction will have no impact on the cash flow statement. When the buyer pays for the items that he previously bought from the project, the project's accountants will record a decrease in accounts receivable by the amount that the buyer has paid and an increase in cash receipts. Only then are these cash receipts included in the cash flow statement as inflows.

Given that the accounts receivable are typically measured as a percentage of sales, the same CSCF used for the output of the project should be used for converting the entries of *change in accounts receivable* in the financial cash flow statement into their corresponding economic values.

The same logic is applicable to the component *change in cash balances* if it is measured as a percentage of sales. However, increases and decreases in cash balances owned by the project

can take place even when no change occurs in sales, accounts receivable, purchases or accounts payable. For example, when cash is set aside for the transactions of the business, it is a use of cash which is represented as an outflow in the cash flow statement. Similarly, a decrease in cash held by the project is a source of cash for the project and its sponsors, and is a cash inflow. Note that any cash set aside will ultimately all be released back to the project (an inflow) at the end of the project. In this case a CSCF of 1 (one) should be used for the component *change in cash balances*.

Purchases

Similar to the distinction between sales and receipts, a distinction is necessary between purchases and cash expenditures. The transaction will be recorded in the cash flow statement only when the cash from the transaction is paid. When the project makes a purchase, the good or service may be delivered to the project but no money transferred from the project to its vendor. At this point the project's accountants will record that the project has a liability called accounts payable equal to the amount of the purchase, or the proportion of it that was not in cash. In other words, the project owes the seller for the goods or services that it has purchased. Until the project has paid for what it has received, the transaction will have no impact on the cash flow statement. When the project pays the vendors for the items it has bought from them, the project's accountants will record a decrease in accounts payable by the amount that the project has paid and an increase in cash expenditures. These cash expenditures will be included in the cash flow statement as an outflow.

Accounts payable are typically measured as a percentage of total purchases or that of a major input. Therefore, either a weighted average of the CSCFs of the purchases, i.e. weighted according to the share of purchases in the total, or the same CSCF of a particular input should be used for that of the component *change in accounts payable*.

Other Working Capital Components

Changes in accrued liabilities should not be included in the cash flow statement. Expenditure is recorded as a cash outflow only at the time an actual outlay takes place. In a similar fashions expenditures made to prepay expenses (e.g. insurance) should be recorded when the expenditure is made.

Changes in inventories should not be included in the cash flow statement. When a project purchases a certain amount of raw material, inventories will increase. These inventories are financed through a cash outflow and/or an increase in accounts payable. If the inventories have been paid for in cash, then a cash outlay has been recorded in the cash flow statement. If they have been acquired on credit terms, then they will be recorded in the cash flow statement only when they are paid for. The situation is similar when dealing with changes in the inventories of the final product. For example, a decrease in final good inventories implies an increase in sales. This in turn implies an increase in cash receipts or accounts receivable.

7. Conclusion

This report has described the comprehensive framework and practical approaches to the estimation of the economic prices and CSCFs for tradable and non-tradable goods and services in Rwanda to be used in the economic appraisal of investment projects in the country. In order to develop the database of CSCFs for Rwanda, the estimation methodologies described in the report are applied to more than 5,000 tradable commodities, and non-tradable goods and services such as transportation, construction, electricity, and telecommunication.

The various distortions associated with tradable commodities in Rwanda, such as import tariffs, excise duties, export taxes, subsidies, VAT, are identified in the report. Then the CSCFs for those goods are estimated in a consistent manner in order to account for the considerable influence of the distortions on the financial price of the tradable goods in the market. The CSCFs are estimated for the cases in which a project either uses the tradables goods as inputs or produces them.

The report has also described an analysis applied to the estimation of economic prices and CSCFs for non-tradable goods and services. As explained in detail, the analysis takes into account all repercussions of the project in the economy by capturing all distortions in the direct product and indirect input markets of the non-tradables.

References

Cambridge Resources International Inc. (2005). Integrated Investment Appraisal: Concepts and Practice. Manual prepared for the Department of Finance and Economic Development (DFED), Limpopo Provincial Government, Republic of South Africa.

Jenkins, G.P., Kuo C.Y. and Harberger A.C. (2011a). Economic Prices for Non-Tradable Goods and Services, DDP 2011-11, John Deutsch International, Queen's University, Canada. URL: http://www.queensjdiexec.org/publications/qed_dp_204.pdf (accessed August 04, 2014).

Jenkins, G.P., Kuo C.Y. and Harberger A.C. (2011b). The Economic Opportunity Cost of Labor, DDP 2011-12, John Deutsch International, Queen's University, Canada. URL: http://www.queensjdiexec.org/publications/qed_dp_205.pdf (accessed August 04, 2014).

Jenkins, G.P., Kuo C.Y. and Harberger A.C. (2011c). The Integrated Analysis of Investment Projects, DDP 2011-01, John Deutsch International, Queen's University, Canada. URL: http://www.queensjdiexec.org/publications/qed_dp_194.pdf (accessed August 04, 2014).

Appendix 1: Identification of Tradable Goods

This appendix describes the theoretical details of the identification of tradable goods. That is to say, the relationship between imported and importable goods, and between exported and exportable goods is explained in the appendix.

A1.1 Imported and Importable Goods

Imported goods are produced in a foreign country but are sold domestically. Importable goods include imports plus all goods produced and sold domestically that are close substitutes for either imported or potentially imported goods. The relationship between importable and imported goods can be seen in Figure A1.1 for the case of an item such as power hand tools used as a project input. Suppose the items purchased by a project are manufactured locally. At the same time, a significant quantity is also being imported. The demander's willingness to pay for this item is shown by the demand curve AD_0, while the domestic marginal cost of production is shown by the supply curve BS_0. If all imports were prohibited, then the equilibrium price would be at P_0, and the quantity demanded and supplied would be at Q_0.

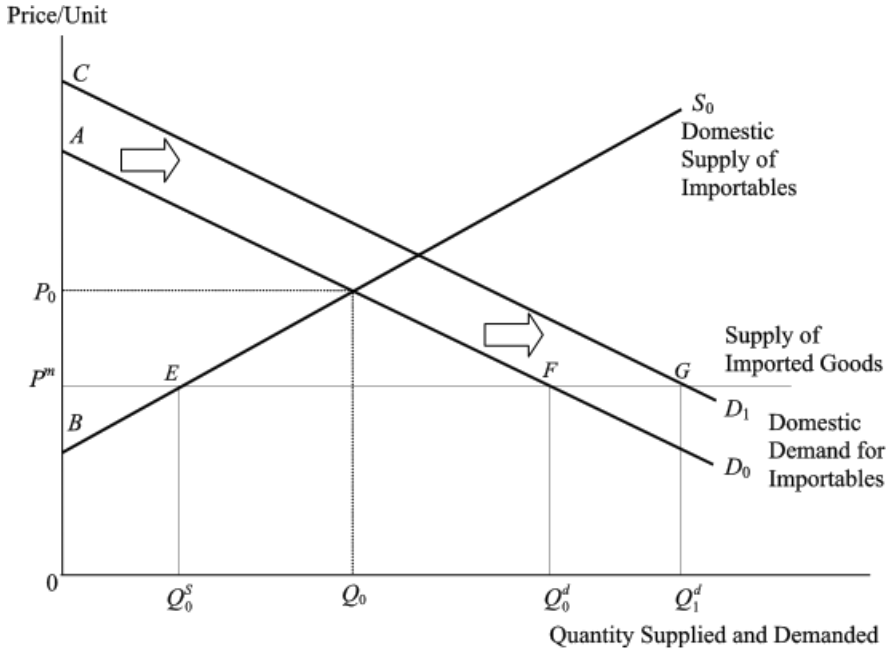

Figure A1.1: Imported and Importable Goods
(the Case of Power Hand Tools Used as Project Input)

Imported goods can be purchased abroad and sold in the domestic market at a price of P^m, which is equal to the CIF price of imports converted into local currency by the market exchange rate, plus any tariffs and taxes levied on imports. This price will place a ceiling on the amount that domestic producers can charge and will thus determine both the quantity of domestic supply as well as the quantity demanded by consumers. When the market price is P^m, domestic producers will maximize their profits if they produce only ${Q_0}^s$ because at this level of output, they will be equating the market price with their marginal costs. On the other hand, demanders will want to purchase ${Q_0}^d$ because it is at this quantity that their demand price is just

equal to the world-market-determined price. The country's imports of the good measured by the amount $({Q_0}^d - {Q_0}^s)$ are equal to the difference between what demanders demand and domestic producers supply at a price of P^m.

If a project now purchases the item as an input, this can be shown as a shift in its demand from AD_0 to CD_1. Unlike a situation where there are no imports, the increase in demand does not cause the market price to rise. This is because a change in the demand for such a traded good in one country will in virtually all cases not lead to a perceptible change in the world price for the commodity. As long as the price of imports remains constant, the increase in the quantity demanded leaves the domestic supply of the good unaffected at ${Q_0}^s$. The ultimate effect of an increase in the demand for the importable good is to increase the quantity of imports by the full amount $({Q_1}^d - {Q_0}^d)$. Thus, to evaluate the economic cost of an importable good, we need to only estimate the economic cost of the additional imports.

Likewise, the value of the benefits derived from a project that increases the domestic production of an importable good should be based entirely on the economic value of the resources saved by the decrease in purchases of imports. In Figure A1.2, we begin with the initial position shown by Figure A1.1 prior to the project's purchase of the item. A project to increase the domestic production of these goods will shift their domestic supply from BS_0 to HS_T. This increase in domestic supply does not result in a fall in price, but rather a decrease in imports, as people now switch their purchases from imported items to the domestically produced ones.

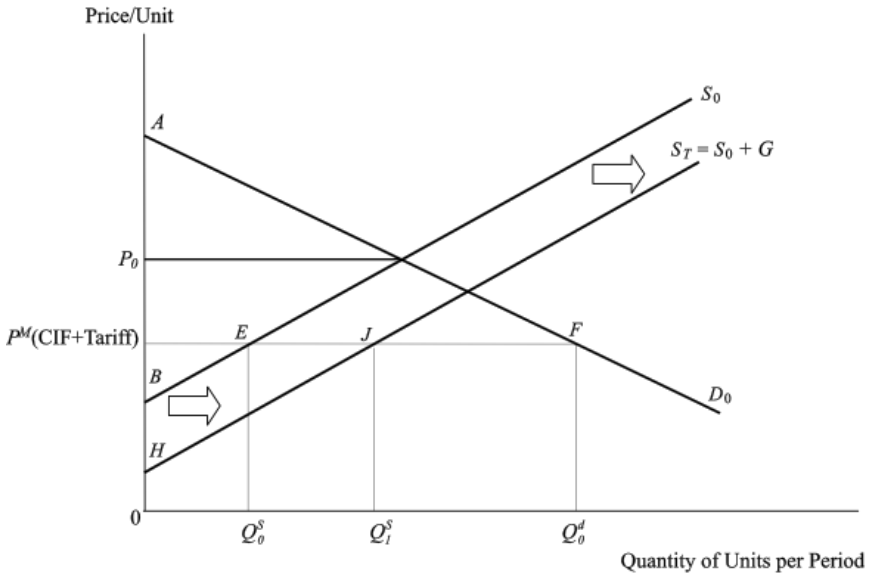

Figure A1.2: Imported and Importable Goods
(the Case of Power Hand Tools Produced Domestically)

Unless the project is big enough to completely eliminate all imports of the item, the domestic price will be pegged to the price of imports, and thus the domestic demand for the input by other domestic consumers will not be changed. Imports will fall from $({Q_0}^d - {Q_0}^s)$ to $({Q_0}^d - {Q_1}^s)$, an

amount equal to the output of the project $({Q_1}^s - {Q_0}^s)$. As domestic production serves as a one-for-one substitute for imported goods, the economic value of the resources saved by the reduction in the level of imports measures the economic value of the benefits generated by the project.

A1.2 Exported and Exportable Goods

Exported goods are produced domestically but sold abroad. Exportable goods include both exported goods as well as the domestic consumption of goods of the same type or close substitutes to the goods being exported. The relationship between exportable and exported goods is very similar to that of importable and imported goods. In Figure A1.3, the demand for an exportable good is shown as KD_0, and the domestic supply of the exportable good is denoted by LS_0.

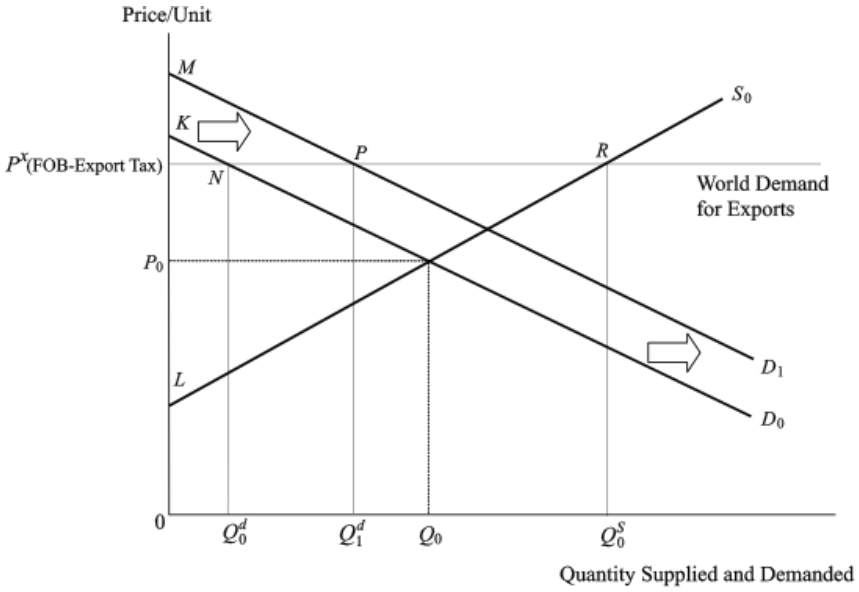

Figure A1.3: Exported and Exportable Goods
(the Case of Timber Used by a Project)

If the domestic production of timber in this country cannot be exported, then domestic supply and demand (Q_0) will come into equilibrium at a price of P_0. However, the commodity will be exportable so long as the domestic market price P^x (i.e., the FOB price times the market exchange rate less export taxes), which domestic suppliers receive when they export, is greater than P_0. If, for example, producers receive a price of P^x (see Figure A1.3), timber production will amount to ${Q_0}^s$. At this price, domestic demand for timber is only ${Q_0}^d$; hence, a quantity equal to $({Q_0}^s - {Q_0}^d)$ will be exported.

We now introduce a project that requires timber as an input, shifting the demand for this exportable good from KD_0 to MD_1. Total domestic demand will now be equal to ${Q_1}^d$, leaving only $({Q_0}^s - {Q_1}^d)$ available to be exported. P^x will remain constant so long as the world price is

not altered by the change in demand due to the project. No changes in incentives have been created that would lead to an increase or decrease in domestic supply. The measurement of the economic cost of this input to the project should be based on the economic value of the foreign exchange that is forgone when the $({Q_1}^d - {Q_0}^d)$ units of timber are no longer exported.

As the market price is fixed by the world price, the benefit of a project that produces such an exportable good should be measured by the value of the extra foreign exchange that is produced when the project's output is reflected in increased exports, while the costs entailed in a project's demanding more of the exportable will be measured by the economic opportunity cost (value) of the foreign exchange forgone.

All importable and exportable goods should be classified as tradable goods. Although an input might be purchased for a project from a domestic supplier, as long as it is of a type similar to ones being imported, it is an importable good and should be classified as tradable. Likewise, goods, if domestically produced and used as project inputs, and if similar to exported goods,[30] are exportable goods and are also included in tradable goods.

[30] It is reasonable to ask whether one should not also include an in-between category of "semi-tradables". These would, by and large, be goods whose price is influenced but not totally determined by external world-market forces. Product differentiation between imports and import substitutes, and between exports and export substitutes, would of course be the principal element defining the in-between category. It is our view that the insertion of a category of "semi-tradables" would further substantially complicate an analytical framework that is a daunting challenge to most countries (to develop a large cadre of practitioners capable of seriously applying it in practice). Our preference is, therefore, to stick with a sharp distinction between tradables and non-tradables. The aim would be to classify some "semi-tradables" as full tradables, thus committing errors in one direction, which one hopes would tend to be substantially offset by classifying other semi-tradables as non-tradables, thus committing errors in the opposite direction.