

# Commodity-Specific Conversion Factors Database for the Republic of Rwanda

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**USER**

**MANUAL**

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# **Introduction**

Rwanda Commodity-Specific Conversion Factors Database (Rwanda CSCF) has been developed by Cambridge Resources International Inc. (CRI) for the Ministry of Finance and Economic Planning of the Republic of Rwanda. The database contains Commodity-Specific Conversion Factors (CSCFs) for estimating economic values for more than 5000 tradable commodities and CSCFs for economic values of Construction, Electricity, Telecommunication, and Transportation services. The database is created to search for, present, and update, whenever necessary, the CSCFs for Rwanda's tradable and non-tradable goods and services. It is designed for professionals involved in the economic and social appraisal of investment projects in Rwanda.

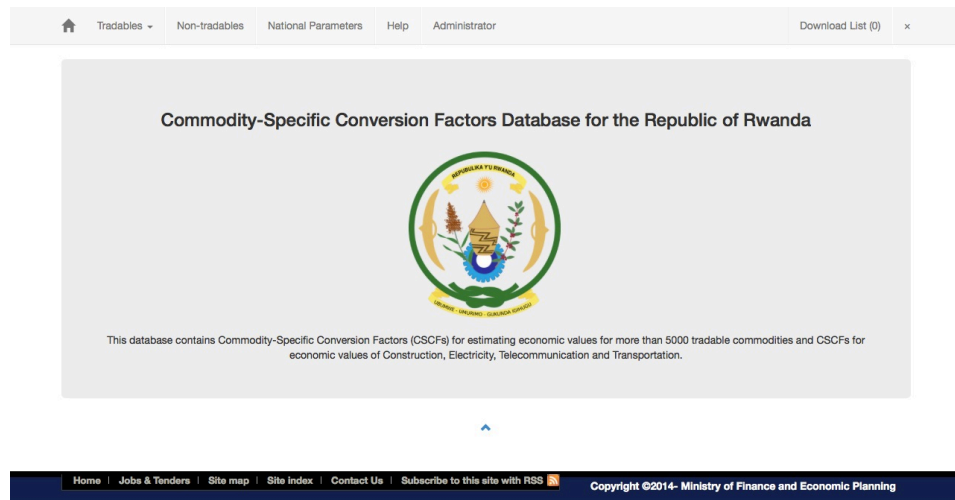
The program provides multiple ways to search and browse the database with an easy to learn interface. CRI has estimated the CSCFs in this database on the basis of the prevailing distortions (taxes, custom duties, subsidies, etc.) in the Rwandan economy.

This user manual provides a helpful guide on how to use the system and all its components. The rest of the manual is organised as follows. The first section describes the user interface of the program. The second section provides a brief discussion of the use of CSCFs in project evaluation, their different types and the choice of the relevant ones when carrying out an economic appraisal of an investment project.

## **Rwanda CSCF Interface**

### **Home Page**

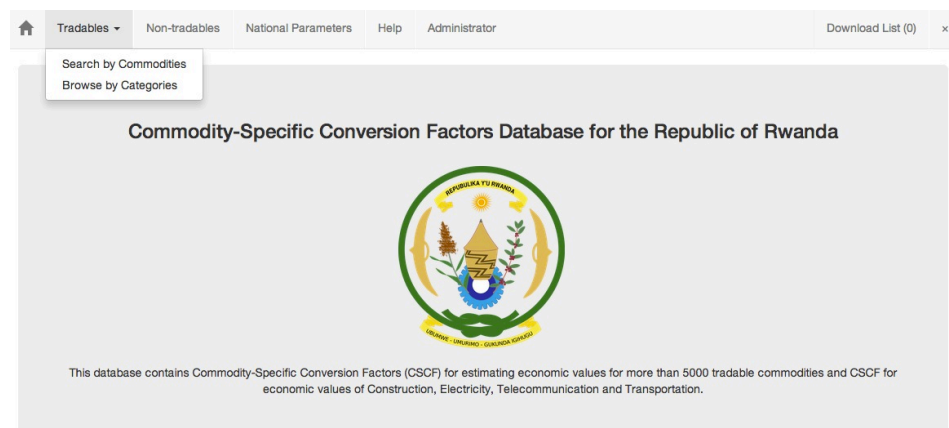
User will be met with a homepage every time they visit the website and from here, they can use the top navigation pane to access all parts of the website.



**Figure 1: Landing Page**

## Search Tradables

The search tradables page is a comprehensive search engine that facilitates the search for over 5000 tradable commodities in the database.



**Figure 2: Search Tradables Page**

In the search bar, a user can search according to **keyword**, **HS Code<sup>1</sup>** or **(Sub)Chapter Number**.

After typing the desired **keyword**, **HS Code** or **(Sub)Chapter Number**, user can press enter or click the search button to reveal the search results. The X symbol can be pressed at anytime to reset the search.

<sup>1</sup> 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.

Home Tradables ▾ Non-tradables National Parameters Help Administrator Download List (0) x

### Search Tradables

x Search

Chapter Sub-chapter Commodity Item

HS Code	Description
31	Fertilisers
31.01	Animal or vegetable fertilisers, whether or not mixed together or chemically treated; fertilisers produced by the mixing or chemical treatment of animal or vegetable products.
31.01.00.00	Animal or vegetable fertilisers, whether or not mixed together or chemically treated;
31.02	Mineral or chemical fertilisers, nitrogenous.
31.02.90.00	- Other, mineral or chemical fertilisers, nitrogenous, including mixtures
31.03	Mineral or chemical fertilisers, phosphatic.
31.03.90.00	- Other mineral or chemical fertilisers, phosphatic
31.04	Mineral or chemical fertilisers, potassic.
31.04.90.00	- Other mineral or chemical fertilisers, potassic

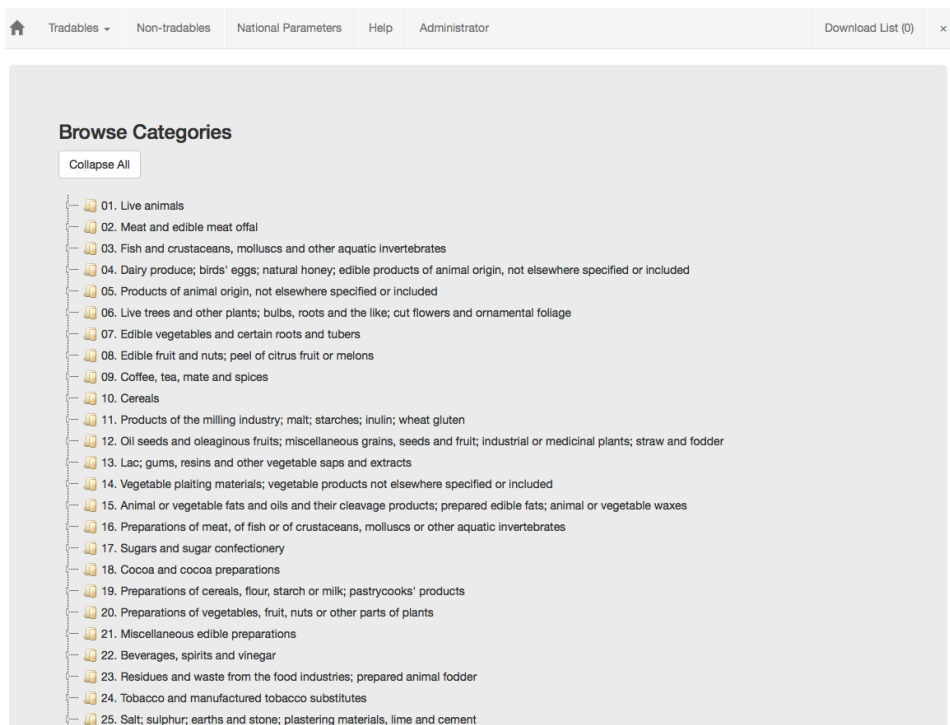
**Figure 3: Sample Search Results for "Fertilisers"**

Search colour coordinates Chapters (Gray), Sub-chapters (Blue) and Commodities (White). The (sub)chapters and commodities are displayed in the database as they are categorised in the HS code.

If a chapter or a sub-chapter is selected, the user is directed to the chapter with all subchapters displayed in the browse tradable page.

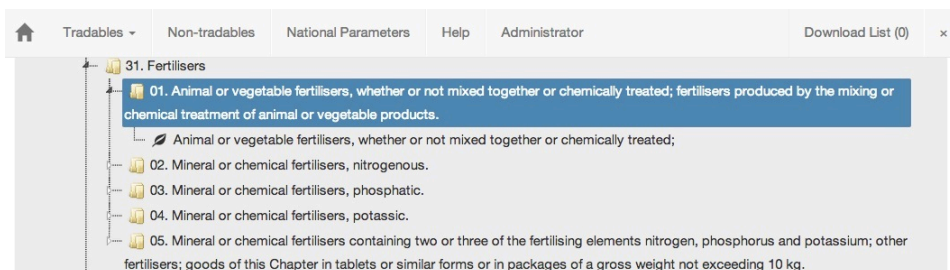
If a commodity is selected, the user is directed to the calculation page where they can view or perform simulations on the CSCF of the selected commodity.

## Browse Tradables



**Figure 4: Browse Categories Page**

Browse categories page provides an alternative way to search through tradable commodities, categorised into 99 HS chapters. When a user selects a chapter, the chapter will expand and reveal all sub-chapters associated with the chapter. Once the sub-chapter is also selected, it will expand to show all commodities within the sub-chapter.



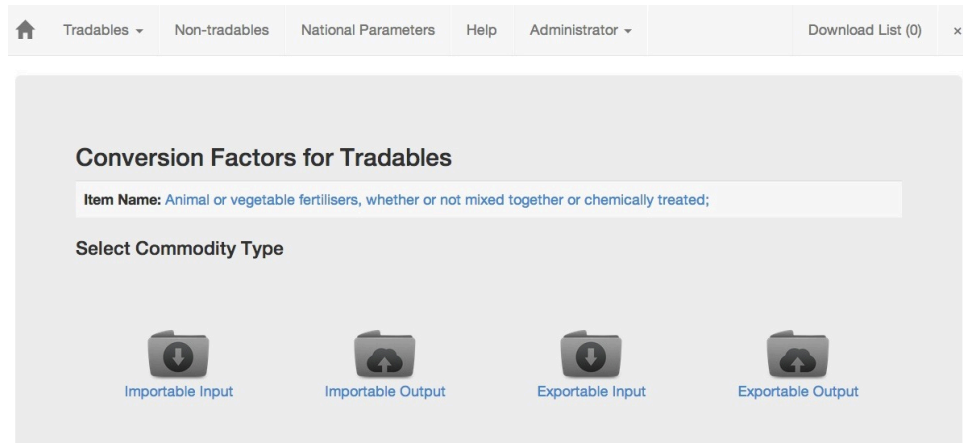
**Figure 5: Sample Chapter, Sub-chapter Expansion**

Once a commodity is selected, the user is directed to the calculation page to view, download and/or perform simulations on the CSCF of the particular commodity.

**Collapse All** button will collapse the tree into its original state.

## Conversion Factors for Tradables

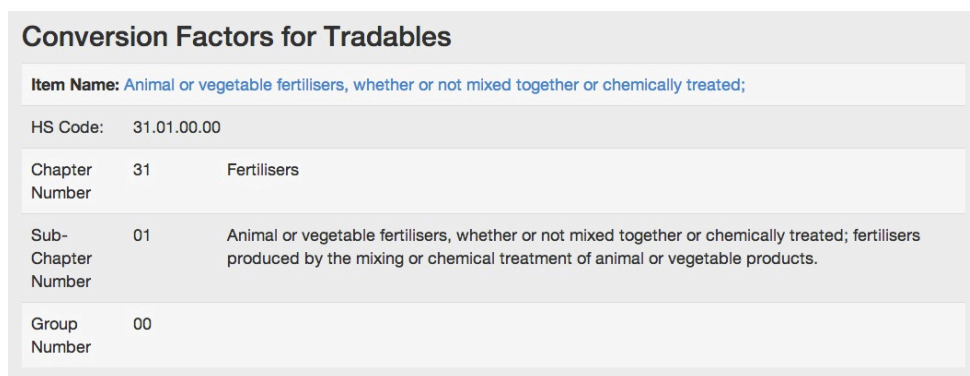
A user can access this page by either searching for a commodity and clicking it on the search tradable page, or alternatively, browsing by category and selecting a commodity via the browse categories page.



**Figure 6: Conversion Factors for Tradables**

**Item Name** refers to the commodity description, in the above example “Animal or vegetable fertilisers” commodity is selected.

Clicking on the item name will reveal detailed information about the commodity such as its HS Code, Chapter Name as well as its Sub-chapter Name.



Conversion Factors for Tradables		
Item Name: Animal or vegetable fertilisers, whether or not mixed together or chemically treated;		
HS Code:	31.01.00.00	
Chapter Number	31	Fertilisers
Sub-Chapter Number	01	Animal or vegetable fertilisers, whether or not mixed together or chemically treated; fertilisers produced by the mixing or chemical treatment of animal or vegetable products.
Group Number	00	

**Figure 7: Expanded Item Details**

Four different commodity types can be selected to reveal different estimations, which are “**Importable Input**”, “**Importable Output**”, “**Exportable Input**” and “**Exportable Output**”.<sup>2</sup>

<sup>2</sup> See the second section of the manual for details of the commodity types.



Once a commodity type is selected, a tab will appear and present the user estimation results as well as options for the user to practice estimations by inputting values into the table.

**Conversion Factors for Tradables**

Item Name: *Animal or vegetable fertilisers, whether or not mixed together or chemically treated;*

Select Commodity Type

Home Importable Input Importable Output Exportable Input Exportable Output

**CSCF<sub>II</sub> = 0.8924**

Show Formula

**Figure 8: Importable Input Commodity Type Selected**

**Show Formula** will reveal the estimation formula for the commodity type.

**Conversion Factors for Tradables**

Item Name: *Animal or vegetable fertilisers, whether or not mixed together or chemically treated;*

Select Commodity Type

Home Importable Input Importable Output Exportable Input Exportable Output

**CSCF<sub>II</sub> = 0.8924**

Hide Formula

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

**Figure 9: Show Formula Expanded**

	Base Input Values - 2014	Updated Input Values
Foreign Exchange Premium (FEP)	5.3%	<input type="text" value="5.3%"/>
Value Added Tax (VAT)	18%	<input type="text" value="18%"/>
Import Duty ( $T_m$ )	0%	<input type="text" value="0%"/>
Import Subsidy ( $k_m$ )	0%	<input type="text" value="0%"/>
Excise Duty ( $T_e$ )	0%	<input type="text" value="0%"/>

Recalculate Reset

Add to Download List

**Figure 10: Simulation Table for Updating Input Values**

**Hide Formula** hides the currently expanded formula.

The table allows a user to input different values and recalculate to display a new estimation result.

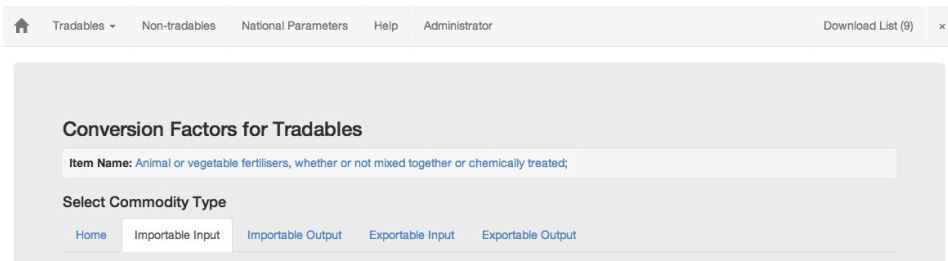
**Base Input Values** are calculated using the base input values as of the designated year.

**Recalculate** commits the Updated Input Values to the formulation and displays the estimation with the updated values.

**Reset** allows resetting of the inputted values for the estimation results.

**Add to Download List** allows users to save their estimation results to an excel file which can be downloaded by pressing the “Download List” from the top menu.

User can add various commodities (tradable and/or non-tradable) or different types of a particular tradable commodity to the download list by clicking “Add to Download List” each time CSCF is displayed for the commodity. Once the desired numbers of items are added to the list, the list can be downloaded by clicking the “Download List” on the top right of the navigation pane.

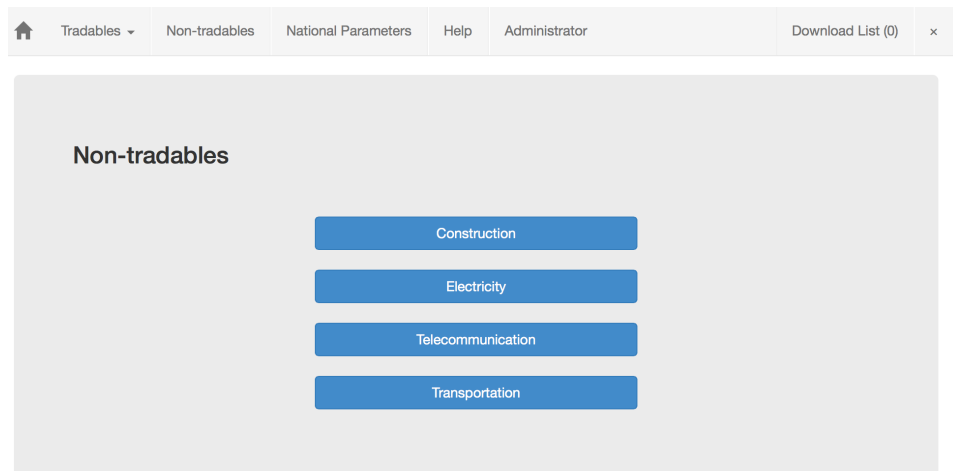


**Figure 11: Download List on Top Right**

By pressing the X button next to the “Download List”, the accumulated list of commodities will be reset back to zero.

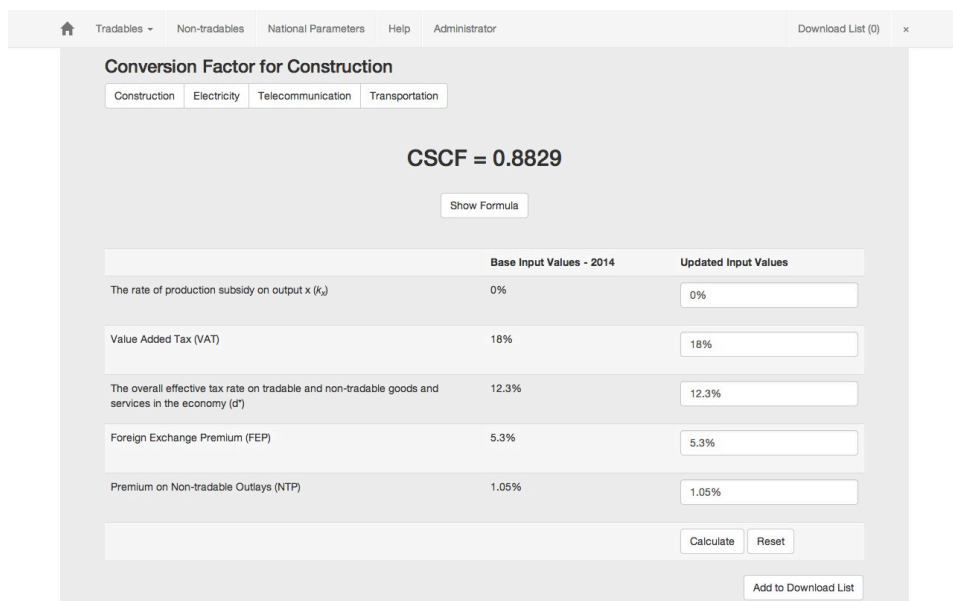
## **Non-tradables**

Non-tradable services “Construction”, “Electricity”, “Telecommunication” and “Transportation” are calculated in this page.



**Figure 12: Non-tradables Landing Page**

Once a user selects a service, they will be redirected to the conversion factors page where they can see the estimation results as well as options for the user to practice estimations by inputting values into the table.



**Figure 13: Non-tradables Estimation Page**

Top menu of the page allows users to quickly switch between different non-tradables without having to go back to the landing page.

**Conversion Factor for Construction**

Construction Electricity Telecommunication Transportation

**CSCF = 0.8829**

Hide Formula

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

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

**Figure 14: Show Formula Button Expanded**

**Show Formula** will reveal the estimation formula for the commodity type as well as the notations associated with the formula.

**Notations:**

- $x$ : Non-tradable output produced or purchased by the project
- $P_x^e$ : Economic price of output  $x$
- $W_x^s$ : Supply weight for output  $x$
- $W_x^d$ : Demand weight for output  $x$  ( $W_x^d + W_x^s = 1$ )
- $P_x^m$ : Market price per unit of output  $x$  (net of value added tax, i.e. VAT)
- $k_x$ : The rate of production subsidy on output  $x$
- $t_x^v$ : VAT on output  $x$
- $d^*$ : The overall effective tax rate on tradable and non-tradable goods and services in the economy
- $a_{ix}$ : Input-output coefficient for tradable input  $i$  used in the production of a unit of output  $x$
- $a_{jx}$ : Input-output coefficient for non-tradable input  $j$  used in the production of a unit of output  $x$
- $P_i^m$ : Market price per unit of input  $i$  (net of VAT)
- $d_i$ : The rate of non-creditable tax or subsidy on the tradable inputs used in the production input  $i$
- $P_j^m$ : Market price per unit of input  $j$  (net of VAT and distortions on tradable components of input  $j$ )
- $t_j^e$ : The rate of non-creditable taxes, e.g., excise taxes, on input  $j$
- $g_j$ : The rate of non-creditable taxes, e.g. import duties and excise taxes, on the inputs of  $j$
- $k_j$ : The rate of production subsidy on input  $j$
- $t_j^v$ : VAT on input  $j$  paid by the new consumers of  $j$
- $T_x$ : Share of tradable components for output  $x$
- $NT_x$ : Share of non-tradable components of output  $x$  ( $T_x + NT_x = 1$ )
- FEP: Foreign exchange premium
- NTP: Premium on non-tradable outlays

**Figure 15: Notations Under the "Show Formula" Button**

**Hide Formula** hides the currently expanded formula.

The table allows a user to input different variables and recalculate to display a new estimation result.

**Base Input Values** are calculated using the base input values as of the designated year.

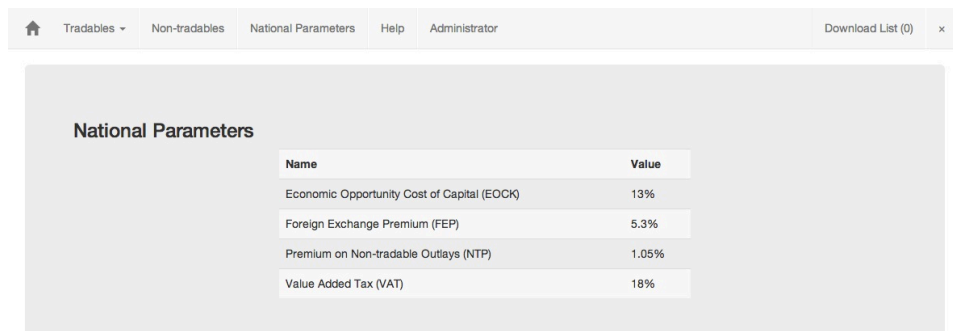
**Recalculate** commits the Updated Input Values to the formulation and displays the estimation with the updated values.

**Reset** allows resetting of the inputted values for the estimation results.

**Add to Download List** allows users to save their estimation results to an excel file which can be downloaded by pressing the “Download List” from the top menu.

## National Parameters

National Parameters are displayed in this page. Only the Administrator of the database can permanently update the National Parameters. As described earlier, users can temporarily update the parameters in calculation pages for simulation purposes.



Name	Value
Economic Opportunity Cost of Capital (EOCK)	13%
Foreign Exchange Premium (FEP)	5.3%
Premium on Non-tradable Outlays (NTP)	1.05%
Value Added Tax (VAT)	18%

**Figure 16: National Parameters Page**

# Use of Conversion Factors in Project Appraisal

## Why Use Conversion Factors

Economic prices account for the real resources consumed or 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 naturally incorporate all the tariffs, taxes and subsidies.

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 times 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.

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

↓

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

## Different Types of Conversion Factors

### Buying or Producing the Commodity

The CSCF is the ratio of a commodity's economic price to its financial price. While the economic price of a commodity will be the same whether the project is producing this commodity as an output or using it as an input, the financial prices could differ from one case to another.<sup>3</sup>

For example, an excise tax (duty) levied on a certain good or the more general VAT will increase the financial price paid by consumers (demand price) but will not affect the cost to producers (supply price). 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 commodity-specific conversion factor will be given the notation  $CSCF_{IO}$  or  $CSCF_{EO}$ , i.e. importable output (IO), exportable output (EO). For non-tradables, however, as there is no difference between the CSCF for inputs and outputs, only the notation CSCF is used.<sup>4</sup>

### Tradable vs. Non-Tradable

While the methodology used for the estimation of internationally tradable goods is the same as that of internationally non-tradable goods and services, the resulting formulas for the estimation of the conversion factors are different. We provide below definitions for tradable and non-tradable goods and services.

A good or service is considered **tradable** when an increase in demand (supply) by a project does not affect the amount demanded (supplied) by

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<sup>3</sup> There is likely to be a difference between the economic value of a commodity demanded by a project (an input) and the economic value of the same commodity when produced by a project (an output) due to possible differences in transport and handling content of the input and the output. If the economic value is estimated at the port (before any domestic freight and handling are taken into account), both economic values will be the same.

<sup>4</sup> See Jenkins (2011a) for technical details.

domestic consumers (producers). The increase in demand (supply) by a project is eventually reflected as an increase (decrease) in imports or a decrease (increase) in exports depending on whether the project is demanding or supplying the importable or exportable commodity.

Rwandan **importable** goods include (a) all goods imported into Rwanda and (b) all goods produced and sold domestically that are close substitutes for either the imported goods or potentially imported goods. An increase in demand for an importable commodity by a project results in an increase in demand for imports. Alternatively, when a project produces an importable commodity, there will be a reduction in imports.

Rwandan **exportable** goods include (a) all goods exported by Rwanda and (b) domestic consumption of similar or close substitutes for the exported goods. An increase in demand for an exportable commodity by a project results in a reduction in exports, while the production of an exportable by a project will result in an increase in exports.

A commodity or service is "**non-tradable**" from Rwanda's point of view if its domestic price lies above its free on board (FOB) export price or below its cost, insurance and freight (CIF) import price. The international transportation cost may be very high compared to the value of the product so that no profitable trade is feasible. Alternatively, an importable good will become non-tradable if it receives such a high level of protection in the form of trade quotas or prohibitive tariffs that no import transactions will take place.

## **Equations for Estimating Conversion Factors**

### **Tradables**

#### ***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:



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

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;
- $k_m$  is the rate of import subsidy expressed as the percentage of the CIF price;
- $T_e$  is the rate of excise duty levied on the CIF price plus the import duty on the imported input; 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.

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:

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

### ***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 value added tax, 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:

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

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.

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:

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

The only difference between the conversion factors for exportable inputs and exportable outputs is the value added tax. If a project is using an exportable input, the financial price to the project will include the value added tax. If, on the other hand, a project is producing a good for export, the supply price to this project will not include the VAT.

### Non-tradables

The number of non-tradable commodities in any economy is typically much smaller than that of tradable commodities. CSCFs were estimated for the following non-tradable services: construction, electricity, telecommunication, and transportation.

The general formula for the estimation of the economic prices of non-tradable goods and services has the following form:

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

where,

- $x$  : Non-tradable output produced or purchased by the project
- $P_x^e$  : Economic price of output  $x$
- $W_x^s$  : Supply weight for output  $x$
- $W_x^d$  : Demand weight for output  $x$  ( $W_x^d + W_x^s = 1$ )
- $P_x^m$  : Market price per unit of output  $x$  (net of value added tax, i.e. VAT)
- $k_x$  : The rate of production subsidy on output  $x$
- $t_x^v$  : VAT on output  $x$
- $d^*$  : The overall effective tax rate on tradable and non-tradable goods and services in the economy
- $a_{ix}^o$  : Input-output coefficient for tradable input  $i$  used in the production of a unit of output  $x$

- $a_{jx}$  : Input-output coefficient for non-tradable input  $j$  used in the production of a unit of output  $x$
- $P_i^m$  : Market price per unit of input  $i$  (net of VAT)
- $d_i$  : The rate of non-creditable tax or subsidy on the tradable inputs used in the production input  $i$
- $P_j^m$  : Market price per unit of input  $j$  (net of VAT and distortions on tradable components of input  $j$ )
- $t_j^e$  : The rate of non-creditable taxes, e.g., excise taxes, on input  $j$
- $g_j$  : The rate of non-creditable taxes, e.g. import duties and excise taxes, on the inputs of  $j$
- $k_j$  : The rate of production subsidy on input  $j$
- $t_j^v$  : VAT on input  $j$  paid by the new consumers of  $j$
- $T_x$  : Share of tradable components for output  $x$
- $NT_x$  : Share of non-tradable components of output  $x$  ( $T_x + NT_x = 1$ )
- $FEP$  : Foreign exchange premium
- $NTP$  : Premium on non-tradable outlays

In line with the case of tradables, CSCF for non-tradables can be calculated as follows:

$$CSCF = \frac{\text{Financial Price}}{\text{Economic Price}} = \frac{P_x^e}{P_x^m \times (1 + t_x)}$$

$$\Downarrow$$

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

# Acknowledgement

## Developing Team

Rwanda Commodity-Specific Conversion Factors Database was designed and programmed by CRI for the Ministry of Finance and Economic Planning (MINECOFIN) of the Republic of Rwanda. The copyrights of the database belong to the MINECOFIN. CRI acknowledges the efforts of the following people involved in the creation and development of the database:

Glenn P. Jenkins	Project Director
George Kuo	Estimation of National Parameters and Conversion Factors
Kemal Bagzibagli	Project Coordination Estimation of National Parameters and Conversion Factors
Caghan Emirzade	Web Development - Project Manager
Eser Ozvataf	Web Development - Software Architect
Bahman Kashi	Senior Associate Economist
Mikhail Miklyaev	Associate Economist
Shahryar Afra	Cost-Benefit Analyst

## References

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