MEASURING THE FOREIGN EXCHANGE PREMIUM AND THE PREMIUM FOR NON-TRADABLE OUTLAYS FOR TWENTY COUNTRIES IN AFRICA

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Development Discussion Paper: 2013-05

ABSTRACT

In this paper we develop an analytical general equilibrium framework to measure the foreign exchange premium and the premium for non-tradable outlays for a country. The framework allows us to capture in a consistent manner the impacts of the sourcing of funds and their expenditure on tradable and non-tradable goods and services of investment projects. An application of the model is carried out for 20 countries in Africa. The results show that the foreign exchange premiums range from 4.00% to 9.50% and the premium for non-tradable outlays from −1.75% to 1.50%. The empirical values depend on a number of factors, including the indirect taxes, production subsidies and international trade distortions of a country. These premiums should be incorporated into the economic evaluation of investment projects.

Revised paper published as: Salci, S. (2013). Measuring The Foreign Exchange Premium And The Premium For Non-Tradable Outlays For Twenty Countries In Africa. *South African Journal of Economics*.

Keywords*:* Distortions, taxes, subsidies, foreign exchange premium, premium for non-tradable outlays, tradable goods, Africa

JEL Classification*:* D58, H23, H43, O55, P45, R13

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1. INTRODUCTION

The objectives of this paper are first, to develop an analytical framework to facilitate the measurement of the foreign exchange premium (FEP) and the premium for non-tradable outlays (NTP), and second, to empirically estimate these parameters for 20 countries in Africa. These variables, along with the economic discount rate, are the key national parameters required for completing accurate and consistent economic analysis of investment projects.

The FEP of a country is defined as the percentage or proportion by which the economic value of foreign exchange exceeds the market exchange rate of that country. Similarly, there is often a gap between economic cost of the resources used to purchase non-tradable goods and services employed by a project and their financial values. The differences arise due to the existence of trade taxes, non-tax barriers, and other indirect taxes and subsidies in the economy. These distortions are often substantial and can be critical in determining the economic feasibility of a prospective investment project.

2. BACKGROUND

The shadow pricing of foreign exchange used to measure the economic values of tradable goods has been much discussed in cost–benefit analysis literature. Some of the most important developments in the early literature can be found in Harberger (1967), UNIDO (1972), Balassa (1974), and Blitzer *et al*. (1981). With exception of Blitzer *et al*. (1981), Jenkins and Kuo (1985), and Harberger and Jenkins (2002), the studies were carried out using a framework for analysis that did not take into consideration the sources of funding that enabled the project to purchase the foreign exchange used to finance the

expenditures on tradable goods and services.

Blitzer *et al*. (1981) conclude that accounting prices for the tradable goods are their border prices unless there is a divergence between the marginal cost and marginal value of domestic income in terms of foreign exchange. They state that in pricing traded goods relative to non-traded goods, a shadow exchange rate must be used that is the nominal exchange rate multiplied by one plus the weighted average rate of total indirect taxes and subsidies. This weighted average rate of indirect taxes and subsidies is equivalent to the FEP explored in this paper.

Jenkins and Kuo (1985) develop a multi-sector general equilibrium model to measure the social cost of foreign exchange for the Canadian economy, taking into account both production and capital subsidies along with import tariffs and commodity taxes. They show that the shadow price of foreign exchange can be evaluated as the sum of the change in the value of the quantities demanded in all sectors of the economy with the combined impact of the financing and purchase of tradable goods. A major problem with that study is the assumption that the project is financed entirely from income taxes. Under these conditions, Jenkins and Kuo find that there is a 6.5% difference between the economic value and the market price of foreign exchange in Canada.

Fane (1991) focuses on the theoretical issues surrounding the partial versus general equilibrium estimation of the shadow price of foreign exchange. He concludes that the shadow price of foreign exchange has a different meaning in the case of a closed economy than it does for a small open economy. Fane suggests that the shadow price of foreign exchange is the most convenient numeraire for shadow pricing in a small open

economy. He also suggests that Harberger's weighted average rule (Harberger, 1967) can be interpreted as the estimation of relative shadow prices using the elasticities of compensated demand and supply curves.

Harberger and Jenkins (2002) develop a three-sector general equilibrium framework in which project funds are sourced in the capital market and then used to purchase either tradables or non-tradables. This goes beyond the traditional partial equilibrium analysis by considering the combined capital market borrowing operation and the purchase of goods and services for the project. The approach allows one to account for most of the impacts on economic welfare that arise from the shifts in demand and supply of the tradables and non-tradables sectors instigated by the combination of the financing and purchasing operations. Harberger *et al*. (2003) model and empirically estimate a three-sector general equilibrium analysis framework for South Africa. The distortions they consider include customs import duties, export taxes, production subsidies, value-added taxes, and other indirect taxes. Because of the distortions prevailing in the market, a wedge is created between the economic and the financial value of tradable or non-tradable project inputs acquired or project output produced by the project. The FEP is estimated at 6% and the NTP is 1% in 2003.

3. ANALYTICAL FRAMEWORK

The conceptual framework employed in this paper is the three-sector general equilibrium model developed by Harberger and Jenkins (2002). We organize the impacts of the sourcing of funds and their spending on tradables and non-tradables in a simple simulation model so that the effects can be accounted for and integrated in a consistent manner. While the model may be aggregate in nature, it is nevertheless detailed enough

to capture the main distortions associated with changes in demand and supply between the tradables and non-tradables sectors after the two market operations take place.

The first market operation is the sourcing of funds from the capital market to finance the purchase of the project's inputs. These funds can be sourced either domestically or abroad. When funds are drawn in the domestic markets, the purchases that would have been made using these funds will be suppressed in terms of reduced consumption and investment expenditures. This creates an excess supply of tradables and non-tradables in the economy. This will not be the case, however, if the funds are raised abroad, since no displacement of domestic investment and consumption will initially take place.

The second market operation is the spending of the funds raised in either the domestic or foreign capital markets. If funds are all spent on tradables, the shadow price of foreign exchange or the FEP can be measured by taking into account all the economic welfare effects caused by the market distortions interacting with the movements in demands and supplies of the tradables and non-tradables sectors. The effect on the economy depends on both the source of the funds and the pattern of the distortions in the markets for goods and services. The net impact of two market operations together creates the FEP, which is expressed as the excess of the economic value over the market exchange rate:

$$FEP = \omega_d \cdot \Delta EW_{t,d} + \omega_f \cdot \Delta EW_{t,f} \qquad (1)$$

where:

ω_d is the proportion of funds sourced domestically,

ω_f is the proportion of funds sourced abroad,

$\Delta EW_{t,d}$ is the change in the economic welfare from the twin actions of sourcing funds from the domestic capital market and spending the funds on tradables, and

$\Delta EW_{t,f}$ is the change in the welfare cost that is due to the sourcing of funds from the foreign capital market and spending these funds on tradables.

Likewise, when funds are spent on non-tradable goods, the NTP can be measured by changes in economic welfare related to the shift in demand and supply between tradable and non-tradable goods and services in the presence of market distortions caused by taxes. That is,

$$NTP = \omega_d \cdot \Delta EW_{nt,d} + \omega_f \cdot \Delta EW_{nt,f} \quad (2)$$

where:

$\Delta EW_{nt,d}$ is the amount of the change in economic welfare that is due to combined action of sourcing of funds via the domestic capital market and spending these funds on non-tradables, and

$\Delta EW_{nt,f}$ is the change in economic welfare effect that is due to the sourcing of funds via the foreign capital market and then spending these funds on non-tradables.

To determine the total impact, we need to estimate the proportions of the funds sourced domestically and abroad, as well as the economic welfare impacts of spending the funds on tradables and non-tradables.[1] Given the existing tax structure and other quantifiable

[1]In each case, the welfare effects are composed of two elements, namely the impact on the domestic indirect taxes and the effect on external taxes. The former is derived from Appendix A, while the latter is obtained from Appendix B.

market distortions in a country, any movement in the demands and supplies of tradables and non-tradables will alter the level of economic welfare. These welfare changes can be evaluated as the markets move from their initial equilibrium to the new one after the completion of these market operations.

The three-sector model of an economy allows us to specify most of the tax and subsidy market distortions and to evaluate the changes in economic welfare caused by the two acts mentioned earlier. The three sectors are the importable, exportable and non-tradable goods and services. Importables and exportables are tradable in the sense that for the country in question there is some international trade in these items.

When these importables or exportables are demanded domestically, the revenues from the value-added taxes, excise taxes, and trade taxes levied on them will be altered, as any change in their domestic demand in turn alters the quantities imported or exported. Since the impacts on the economy differ in each case, there would be different economic welfare cost implications. In the following sections we will first describe the impacts of each case and then summarize the total effects on the economy, depending on the source of the funds.

3.1 Estimation of the FEP

The FEP captures the distortions in changes in economic welfare created by the taxes and subsidies levied in the markets in which foreign exchange is used or generated. For a project that uses foreign exchange, these funds can be sourced either domestically or abroad. We begin with the case in which funds are sourced in the domestic market to

purchase the foreign exchange, and then deal with the case in which funds are sourced abroad.

A. Funds Sourced Domestically are Spent on Tradable Goods

When funds are extracted from the domestic capital market to finance the purchase of tradable goods, this will reduce the expenditures made by other businesses and consumers on tradable and non-tradable goods and services. The decrease in the demand for tradable goods or services will reduce the amounts of value-added tax (VAT) and excise taxes collected. In the case of VAT, businesses will be credited for all the tax paid on purchases of business inputs to offset the VAT liabilities from their sales.[2] As a consequence, only $(1-\rho_i)$ of the displaced expenditures from the capital market operation will affect VAT payments, where ρ_i refers to the proportion of expenditures during the capital market extraction that is excluded from VAT because of the input tax credit. This is shown in the first two items of equation (3). Using the domestic currency as a numeraire, the real exchange rate, *E*, reflects the relative price of tradable to non-tradable goods.

In the case of excise duty or taxes, most of these are on consumer goods such as alcoholic beverages, tobacco products, and cosmetics, which are tradable and also taxable. Even in the case of excise duty on fuel purchased by businesses, these are not usually creditable. The effect on non-tradable goods is captured in the third item of equation (3). Thus, ΔEW_1 captures the total impact on the welfare cost that is due to changes in the domestic

[2] An explanation can be found in, for example, Bird and Gendron (2005).

indirect taxes inclusive of VAT and excise taxes collected over the process of the extraction of funds from the domestic capital market.[3]

$$\Delta EW_1 = \left[\left(v_t (1-\rho_i) \frac{\partial Q_{d,t}}{\partial F^D} \right) E + \left(v_{nt} (1-\rho_i) \frac{\partial Q_{d,nt}}{\partial F^D} \right) + \left(t_{e,nt} \frac{\partial Q_{d,nt}}{\partial F^D} \right) \right] dF^D \qquad (3)$$

where:

v_t is the effective VAT rate on the demand for tradables,

v_{nt} is the effective VAT rate on the demand for non-tradables,

$t_{e,nt}$ is the effective excise tax or duty rate on non-tradables,

dF^D is the amount of funds raised through the domestic capital market,

$\partial Q_{d,t} / \partial F^D$ is the reduction in the demand for tradables that is due to the domestic capital market extraction, and

$\partial Q_{d,nt} / \partial F^D$ is the reduction in the demand for non-tradables that is due to the domestic capital market extraction.

As the sourced funds are totally spent on tradables, this will create a net excess demand for tradables and a net excess supply of non-tradables in the economy. This disequilibrium situation will cause a rise in the relative price of tradables to non-tradables. As a consequence, there will be a decrease in the quantity of tradables demanded, but an increase in the demand for non-tradables. The suppliers of tradables will find it profitable to produce more, while suppliers of non-tradables will produce less. The process will continue until a new equilibrium is reached in which no excess supply exists in the tradables sector owing to adjustments through the flexible exchange rate.

[3] The impact on tradable excise taxes is captured in equation (10), below.

The resources required to produce the additional tradables will come from the reduction in the production of non-tradables. Equilibrium is again established when the sum of the total demand for tradables and non-tradables (Q_d) equals the supply of tradables and non-tradables (Q_s).

$$Q_d = Q_{d,t}\mathrm{E} + Q_{d,nt} = Q_{s,t}\mathrm{E} + Q_{s,nt} = Q_s \tag{4}$$

where:

$Q_{d,t}$ and $Q_{d,nt}$ are the demand for tradables and non-tradables, respectively, and

$Q_{s,t}$ and $Q_{s,nt}$ are the supply of tradables and non-tradables, respectively.

Given the resource constraint, Q_s remains unchanged before and after sourcing of funds in the capital market and spending on either tradables or non-tradables. However, the equilibrium in the economy is disturbed on the demand side by the project's increased demand for either tradables $\left(Q^P_{d,t}\right)$ or non-tradables $\left(Q^P_{d,nt}\right)$, while at the same time there is a fall in demand for tradables and non-tradables caused by the extraction of funds from the capital market. The net change will be an excess demand for tradable goods if the project spends all the funds on tradable goods. Alternatively, there will be an excess supply of tradable goods if the funds are all spent on non-tradable goods. In the end, the total demand and supply of goods and services must be equal, as the real exchange rate acts to facilitate adjustments. Thus, equation (4) is modified as follows:

$$Q_d = Q_{d,t}E + Q_{d,nt} + Q^P_{d,t}E + Q^P_{d,nt} = Q_{s,t}E + Q_{s,nt} = Q_s \tag{5}$$

As a consequence of the adding-up properties of demand in a two-good economy, the following equation with respect to the real exchange rate must hold:

$$\partial Q_{d,t} / \partial E + \partial Q_{d,nt} / \partial E = 0 \tag{6}$$

Using the compensated own-price elasticity of demand for tradables $\left(\eta_t^d\right)$[4] and the compensated cross-price elasticity of demand for non-tradables $\left(\eta_{nt}^d\right)$ with respect to a change in the foreign exchange rate, the above relationship can be derived as follows:

$$\eta_t^d = -\eta_{nt}^d \left(Q_{d,nt} / Q_{d,t}\right) \tag{7}$$

This condition provides us with a consistency check in the market operations. By the same token, the relationship holds for the supply side.[5]

$$\varepsilon_t^s = -\varepsilon_{nt}^s \left(Q_{s,nt} / Q_{s,t}\right) \tag{8}$$

These substitution effects on the welfare cost as shown in equation (9) can be measured by the net impact on the domestic indirect taxes and production subsidies associated with the change in quantities of tradables and non-tradables demanded and supplied. The first

[4]The tradable demand is broken down into demand for importables and demand for exportables. The compensated demand elasticity for tradables $\left(\eta_t^d\right)$ can then be shown by the weighted average of the elasticities of demand for importables $\left(\eta_i^d\right)$ and exportables $\left(\eta_e^d\right)$ with respect to the real exchange rate. That is $\eta_t^d = \eta_i^d \theta_i^d + \eta_e^d \theta_e^d$ where θ_i^d and θ_e^d stands for the share of the demand for importables and exportables in total tradables, respectively.

[5]Similarly, the supply elasticity of tradables $\left(\varepsilon_t^s\right)$ is equal to the weighted average of the elasticities of supply of importables $\left(\varepsilon_i^s\right)$ and exportables $\left(\varepsilon_e^s\right)$. That is, $\varepsilon_t^s = \varepsilon_i^s \theta_i^s + \varepsilon_e^s \theta_e^s$ where θ_i^s and θ_e^s stand for the share of the supply of importables and exportables in total tradables, respectively.

term refers to changes in the amount of VAT collected and subsidy provided to the production of tradables, while the second term is composed of changes in VAT and excise tax/duty collected and subsidy provided for the production of non-tradables.

$$\Delta EW_2 = \left[\left(\frac{v_t(1-\rho_s)\eta_t^d}{\varepsilon_t^s-\eta_t^d} - \frac{k_t\varepsilon_t^s}{\varepsilon_t^s-\eta_t^d}\right)E + \left(\frac{v_{nt}(1-\rho_s)\eta_{nt}^d}{\varepsilon_t^s-\eta_t^d} + \frac{t_{e,nt}\eta_{nt}^d}{\varepsilon_t^s-\eta_t^d} - \frac{k_{nt}\varepsilon_{nt}^s}{\varepsilon_t^s-\eta_t^d}\right)\left(\frac{Q_{d,nt}}{Q_{d,t}}\right)\right]\left(1+\frac{\partial Q_{d,t}}{\partial F^D}\right)dF^D \quad (9)$$

where:

ε_t^s and ε_{nt}^s are the own-supply elasticity of tradables and the cross-supply elasticity of non-tradables with respect to changes in the real exchange rate, respectively,

k_t and k_{nt} are the production subsidies on tradables and non-tradables, respectively, and

ρ_s is the proportion of the changes in demand resulting from the exchange rate adjustment that are excluded from VAT because they are changes in creditable business inputs.

In addition to the domestic VAT and excise taxes, there are other distortions, such as import duties, excises, and export taxes associated with changes in the equilibrium quantities of demand and supply of tradable goods while crossing borders, i.e., imports and exports. In order to assess these impacts, we need to separate the demand and supply of tradables into importable and exportable components, that is, $Q_{d,t} = Q_{d,i} + Q_{d,e}$ and $Q_{s,t} = Q_{s,i} + Q_{s,e}$. It should be noted that so long as the price of imports remains unchanged, an increase in the demand for the importables will ultimately increase the quantity of imports, since the domestic supply of the good will not be affected. The

effects of these changes on welfare cost over the capital extraction are measured by ΔEW_3:[6]

$$\Delta EW_3 = \left[\left(t_m \frac{\partial Q_{d,i}}{\partial F^D}\right) + \left(t_e(1+t_m)\frac{\partial Q_{d,i}}{\partial F^D}\right) + \left(t_x \frac{\partial Q_{d,e}}{\partial F^D}\right)\right](E)dF^D \qquad (10)$$

where:

t_m is the effective import duty rate,

t_x is the effective export tax rate, and

t_e is the effective excise tax or duty on tradable goods.

The fourth component (ΔEW_4) accounts for welfare cost caused by import duties, excise taxes on tradables, and export taxes associated with changes in quantities of imports and exports that are due to changes in the real exchange rate (or substitution effects). Given that a trade deficit in a country must reflect an excess demand of equal size for the country's total tradables,[7] ΔEW_4 can be measured as follows:

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

(11)

where:

ε_X^s is the own-price supply elasticity of exports,

η_M^d is the own-price demand elasticity of imports,

[6] The impacts expressed in equations (10) and (11) are derived from Appendix B.

[7] That is, $Q_{s,t} - Q_{d,t} = Q_X^s - Q_M^d$. This can be translated into the following relationship: $\varepsilon_t^s - \eta_t^d = \varepsilon_X^s \left(Q_X^s / Q_{s,t}\right) - \eta_M^d \left(Q_M^d / Q_{d,t}\right)$. See, for example, Jenkins *et al*. (2013).

Q_X^s is the amount of exports, and

Q_M^d is the amount of imports.

B. Foreign Funds are Spent on Tradable Goods

When funds sourced abroad are spent on tradable goods, there is no excess domestic demand for foreign currency, nor is there an excess demand for domestic currency. Thus, there is no impact on the demand and supply of tradables or non-tradables in the domestic economy, and no additional welfare cost will occur, that is, $\Delta EW_{t,f} = 0.$

Assuming the amount of funds raised in the economy is one unit of foreign currency, FEP can then be measured by substituting the sum of the welfare costs calculated from equations (3), (9), (10) and (11) into equation (1):

$$\begin{aligned} FEP &= \omega_d \cdot \Delta EW_{t,d} + \omega_f \cdot \Delta EW_{t,f} \\ &= \omega_d \cdot \left[\Delta EW_1 + \Delta EW_2 + \Delta EW_3 + \Delta EW_4\right] \end{aligned} \tag{12}$$

3.2 Estimation of the NTP

The NTP is a premium equivalent to the FEP that is associated with non-tradable outlays, where funds are raised in the capital market to finance the purchase of non-tradables. It is the amount by which the economic outlays exceed the financial outlays. Again, we shall first measure the distortions related to each of the funds sourced either domestically or abroad.

C. Domestic Funds are Spent on Non-tradable Goods

In this case, the impacts of the capital extraction will have the same effects as presented in case A, as expressed in equations (3) and (10).

When the funds are spent on non-tradables, there will be an excess demand for non-tradables and an excess supply of tradables. This will cause the relative price of non-tradables to tradables to increase (or the real exchange rate to decline), inducing suppliers in the non-tradables sector to expand in which additional resources must be moved from tradables sector to non-tradables sector. The process will continue until the excess demand for non-tradables is diminished and equilibrium is re-established. The adjustment process is the reverse to that presented in case A.

The impacts of these adjustments on the economy are two-fold. The first effect is the change in welfare cost (ΔEW_5) associated with changes in domestic taxes, including VAT, excise taxes, and production subsidies that are due to the change in the real exchange rate. This can be measured as follows:[8]

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

(13)

The second effect (ΔEW_6) is the change in welfare cost associated with changes in import duties, excise taxes, and export taxes as a result of changes in the real exchange rate. This component can be calculated as follows:

[8] The derivation of equations (13) and (14) can be found in Appendix B.

$$\Delta EW_6 = \left[\left(\frac{t_m \eta_M^d \left(Q_M^d / Q_{d,t}\right)}{\varepsilon_t^s - \eta_t^d}\right) + \left(\frac{t_e (1+t_m) \eta_M^d \left(Q_M^d / Q_{d,t}\right)}{\varepsilon_t^s - \eta_t^d}\right) - \left(\frac{t_s \varepsilon_X^s \left(Q_X^s / Q_{s,t}\right)}{\varepsilon_t^s - \eta_t^d}\right)\right](E)\left(\frac{\partial Q_{d,t}}{\partial F^D}\right) dF^D \quad (14)$$

The total welfare cost in this case can be measured by the sum of $\Delta EW_1, \Delta EW_3, \Delta EW_5$ and ΔEW_6.

D. Foreign Funds are Spent on Non-tradable Goods

When foreign funds are sourced, there is no impact on the domestic economy as a result of the funds being extracted abroad. Until the funds are spent on non-tradables, an additional demand for non-tradables will cause an increase in the price of non-tradable goods relative to that of tradable goods. The impact in this case is greater than that described in case C, since there is no initial displacement of domestic investment and consumption in non-tradable goods to be offset. As a consequence, the supply of non-tradables will need to expand much more, demanding greater resources in the sector that must be released from the tradables sector. Production in the tradables sector will contract because of the depressed market price for tradables.

There is only a substitution effect in this case. These effects can be separated into two parts. The first is the change in welfare cost (ΔEW_7) associated with changes in VAT, excise taxes, and production subsidies. It can be calculated as follows:

$$\Delta EW_7 = \left[\left(\frac{v_t (1-\rho_s) \eta_t^d}{\varepsilon_t^s - \eta_t^d} - \frac{k_t \varepsilon_t^s}{\varepsilon_t^s - \eta_t^d}\right)E + \left(\frac{v_{nt} (1-\rho_s) \eta_{nt}^d}{\varepsilon_t^s - \eta_t^d} + \frac{t_{e,nt} \eta_{nt}^d}{\varepsilon_t^s - \eta_t^d} - \frac{k_{nt} \varepsilon_{nt}^s}{\varepsilon_t^s - \eta_t^d}\right)\left(\frac{Q_{d,nt}}{Q_{d,t}}\right)\right]\left(\frac{\partial Q_{d,t}}{\partial F^F}\right) dF^F \quad (15)$$

The second part (ΔEW_8) is the change in customs duties, excise taxes and export taxes associated with the changes in demand and supply of tradable goods when these goods cross borders. This can be shown as follows:

$$\Delta EW_8 = \left[\left(\frac{t_m \eta_M^d \left(Q_M^d / Q_{d,t}\right)}{\varepsilon_t^s - \eta_t^d}\right) + \left(\frac{t_e (1+t_m) \eta_M^d \left(Q_M^d / Q_{d,t}\right)}{\varepsilon_t^s - \eta_t^d}\right) - \left(\frac{t_s \varepsilon_X^s \left(Q_X^s / Q_{s,t}\right)}{\varepsilon_t^s - \eta_t^d}\right)\right](E)\left(\frac{\partial Q_{s,t}}{\partial F^F}\right) dF^F \quad (16)$$

Thus, the total economic welfare effect in this case is simply the sum of ΔEW_7 and ΔEW_8. Since funds used for the projects are sourced domestically as well as abroad, the NTP should be estimated as a weighted average of the welfare costs associated with each source of funds. This can be done by substituting the welfare costs calculated from equations (3), (9), (13), (14), (15) and (16) into equation (2):

$$\begin{aligned} NTP &= \omega_d \cdot \Delta EW_{nt,d} + \omega_f \cdot \Delta EW_{nt,f} \\ &= \omega_d \cdot \left[\Delta EW_1 + \Delta EW_3 + \Delta EW_5 + \Delta EW_6\right] + \omega_f \cdot \left[\Delta EW_7 + \Delta EW_8\right] \end{aligned} \quad (17)$$

4. EMPIRICAL ESTIMATION

4.1 Assumptions and Parameters used in the Model

The analytical framework for measuring the FEP and the NTP was presented in the previous section. To measure these premiums, we need to estimate all the parameters presented in the various formulas. The first is the proportion of funds sourced domestically and abroad in order to finance the purchase of tradables or non-tradables. The second is the relative sizes of tradable and non-tradable goods in the economy, this being used to measure the interrelated impacts between the tradables and non-tradables

sectors. The third is the demand and supply elasticities of imports, exports, and non-tradable goods with respect to the real exchange rate. The last parameter is the effective tax rate for each of the major indirect taxes and the effective production subsidy rate.

Each country in Africa may be unique in terms of its economic structure and various distortions prevailing in the economy. There are also issues regarding the availability of data and whether they are detailed enough to calculate parameters required for this study. We will present the estimates for South Africa to illustrate how the parameters can be derived. The information for South Africa is generally detailed enough to be used to measure the FEP and NTP, is publicly available, and may serve as a general guide when carrying out the estimates for other countries.

4.1.1 Alternative Sources of Funds

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

This parameter is best estimated from the marginal sources of funds for investment when funds are raised in the capital market. For a small and open economy, when funds are raised in the capital market the interest rate will be raised slightly, which will stimulate domestic savings for households, release funds from displaced investment and induce additional foreign capital inflows.[9] The first two of these are domestic market sources,

[9] See Harberger (1972) and Jenkins *et al*. (2013), Chapter 8.

while the third is from foreign savers. Their shares $(\partial F^D / \partial F)$ and $\left(\partial F^F / \partial F\right)$ can be estimated at the marginal sourcing as follows:

$$\partial F^D / \partial F = \left[\varepsilon_h \left(S_h / S_t\right) - \eta \left(I_t / S_t\right)\right] / \left[\varepsilon_h \left(S_h / S_t\right) + \varepsilon_f \left(S_f / S_t\right) - \eta \left(I_t / S_t\right)\right] \quad (18)$$

$$\partial F^F / \partial F = \left[\varepsilon_f \left(S_f / S_t\right)\right] / \left[\varepsilon_h \left(S_h / S_t\right) + \varepsilon_f \left(S_f / S_t\right) - \eta \left(I_t / S_t\right)\right] \quad (19)$$

where:

ε_h is the supply elasticity of household savings,

ε_f is the supply elasticity of foreign funds,

η is the demand elasticity for private-sector domestic investment with respect to changes in the rate of interest,

S_h/S_t is the share of household savings in total private-sector savings,

S_f/S_t is the share of foreign savings in total private-sector savings, and

I_t/S_t is the ratio of total private-sector investment to total savings.

The average share of household savings can be approximately estimated by the ratio of savings by nationals to investment expenditures.[10] In the absence of detailed data, the starting point is to assume that total private domestic investment is totally financed by total private savings inclusive of foreign capital inflows, which implies that the ratio of I_t to S_t will be 1.

[10]This can be obtained from World Bank (2011).

The responsiveness of household savings, foreign savings, and private investment to interest rates is a matter of considerable debate. However, the general consensus from the literature indicates that the supply elasticities of funds are approximately 0.4 for household savers and 2.0 for foreign savers,[11] while the demand elasticity of investment is about −1.0. Given these assumptions we are able to estimate the proportions of funds sourced domestically and abroad at margin.

For South Africa, it is estimated that the proportion of funds sourced from the domestic markets is 74% and from foreign savers 26%.[12] The extent to which each source contributes to the funds depends upon the response of each sector of the economy to the real interest rate.

4.1.2 Tradables versus Non-tradables

Most of the African countries have been in a trade deficit position for years. The share of the demand for importables is much greater than that of exportables and thus, the importable demand is assumed to represent a much greater share of total tradables than exportable demand. For the purpose of this study, the demand for importables is assumed to account for 80% of the total tradable demand in an economy. On the other hand, the supply of importables is assumed to be 40% of the total supply of tradables. For South Africa, we have calculated that the supply of importables was about 30% of the total supply of tradables.[13]

[11] These assumptions have been widely used elsewhere. See, e.g., Boskin (1978), Leipziger (1974), Burgess (1981), and Jenkins (1981).
[12] See, e.g., Kuo *et al*. (2003). Naturally, sensitivity analysis should be performed for some key variables such as the supply elasticity of foreign savings.
[13] This is calculated based on Statistics South Africa (1998).

With regard to assessing the impact on the economy of the capital extraction alone, the proportion of importables can be more than the 80% that is assumed for the economy as a whole because tradable goods make up a larger share of total investment, including machinery, equipment, steel etc. In the case of South Africa, it is estimated that about 85% of funds are sourced from the displacement of investment and 15% from consumption forgone in response to stimulated household savings.[14] Of the displaced investment, about two-thirds were tradable goods such as machinery, equipment, motor vehicles, and structural metal products in 1998.[15] The remainder was building and infrastructure, which are considered non-tradable. As a consequence, the displaced demand for tradables that is due to borrowing domestically is 68.95% for South Africa over the capital market extraction.[16]

Examining domestic capital extraction, displaced tradable goods such as machinery, equipment, and motor vehicles are mainly importables. Accordingly, the demand for importables as a proportion of the total demand for tradable capital formation could be as high as 95%, or 85% at a conservative estimate. As regards tradable consumption, 80% is assumed to be importables, the same proportion as for the economy as a whole. With these assumptions, the displaced importables as a proportion of total tradables is estimated to be as high as 84% for South Africa during the initial capital market extraction.

[14] When funds are raised in the capital market to finance a project or program, the ultimate sources of these funds are 62.5% from those that would have been invested in other domestic activities, 11.5% from stimulated household savings, and 26.0% from additional foreign capital inflows. This implies that of the domestic sources, 84.5% come from displacement investment and 15.5% from household consumption forgone. See Kuo *et al*. (2003).

[15] See details by commodity for fixed capital formation in Statistics South Africa (1998), Table 4: Use of Products at Purchasers' Prices.

[16] This is estimated by the sum of 15%*0.80 + 67%*0.85 with the assumption that household demand for consumption is 80% tradable.

4.1.3 Demand and Supply Elasticities

The demand and supply elasticities of tradable or non-tradable goods are important for quantifying the response of their demand and supply to the relative price of tradable to non-tradable goods. A change in this relative price is equivalent to the change in the real exchange rate. If the real exchange increases, the demand for importable goods will decrease, as will the amount of import duty collections. Such an increase will also reduce the amount of VAT and other indirect taxes associated with the demand for either importables or exportables.

Precise estimates of demand (or supply) elasticities of tradables and non-tradables are not readily available in the literature. The former can be estimated as a weighted average of demand (or supply) of importables and exportables. In this study, the compensated own-price elasticities of demand for importables and exportables are assumed to be −1.0, and the compensated own-price elasticity of demand for tradables $\left(\eta_t^d\right)$ will also be −1.0. On the supply side, the price elasticities of supply of exportables and importables are assumed to be +1.0, while the own-price supply elasticity of tradables $\left(\varepsilon_t^s\right)$ will also be +1.0.

Given the resources available in the economy, in order to ensure the market equilibrium the derived compensated own-price elasticity of demand for tradables must be equal to the compensated cross-price elasticity of demand for non-tradable $\left(\eta_{nt}^d\right)$ multiplied by the ratio of the demand for non-tradables to the demand for tradables $\left(Q_{d,nt}/Q_{d,t}\right)$ as shown in equation (4). The supply elasticity of tradables also equals the cross-price elasticity of

supply of non-tradables $\left(\varepsilon_{nt}^{s}\right)$ multiplied by the ratio of the supply of non-tradables over the supply tradables $\left(Q_{s,nt}/Q_{s,t}\right)$.

That being said, in order to quantify the effects on the amount of import duties and export taxes, we must estimate the compensated own-price elasticity of demand for imports $\left(\eta_{M}^{d}\right)$ and the supply elasticity of exports $\left(\varepsilon_{X}^{s}\right)$. The former is calculated as the compensated own-price elasticity of demand for importables multiplied by the ratio of the demand for importables to the amount of imports, minus the price elasticity of supply of importables multiplied by the ratio of supply of importables to the amount of imports. The latter is calculated by the price elasticity of supply of exportables multiplied by the ratio of the supply of exportables to the amount of exports, minus the compensated own-price elasticity of demand for exportables multiplied by the ratio of the demand for exportables to the amount of exports. Given the economic structure of South Africa in 1998 (Statistics South Africa, 1998), the ratios of the demand and supply of importables to imports are estimated to be about 1.6 and 0.6, respectively. It follows that the demand elasticity for imports $\left(\eta_{M}^{d}\right)$ would be −2.20. Likewise, the ratios of supply and demand for exportables to exports are estimated to be approximately 1.4 and 0.4, while the supply elasticity of exports $\left(\varepsilon_{X}^{s}\right)$ would be 1.80.

4.1.4 The Effective Tax and Subsidy Rates

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

Import Tariff

The effective import tariff rate is calculated by dividing the total import duty collections by the amount of imports at CIF (cost, insurance and freight) value, as presented in Sections 3.1 and 3.2. The tax rate includes tariffs and any other surcharges associated with imported commodities or use-up of foreign exchange related to imports of those commodities.

For example, the average effective tax rate (t_m) for South Africa ranged from 2.48% to 4.16% during the seven-year period 2003–2009. For the purpose of evaluating projects in the future, we consider the average rate of the latest two years, which was 2.66%. There is no tax imposed on exported goods sold in world markets for South Africa.

Value-Added Tax

The effective tax rate for VAT is calculated as the amount of VAT collected as a percentage of total household final consumption expenditures.[17] This is due to the nature of a consumption-type VAT, which is the system commonly operated around the world. Although VAT is a multi-stage sales tax, the invoice-credit method allows businesses full credits for the taxes paid on business inputs, including capital assets. As a result, the final consumers bear the burden of the tax. For social, health, or technical reasons, some goods and services are tax exempt in virtually all VAT jurisdictions. Small businesses whose turnovers are less than the threshold are also excluded from the tax system for administrative reasons. Under these circumstances, businesses cannot claim input tax

[17] Household final consumption expenditure is defined as the market value of all goods and services purchased by households. The amount excludes purchases of newly constructed dwellings, but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments in order to obtain permits and licenses.

credit against the taxes collected from sales. For all intents and purposes, we assume that these taxes would be fully shifted forward to the final consumption in higher prices and become part of the average effective tax rate.

In addition, the effective tax rates of tradable and non-tradable goods are substantially different. For countries covered in this study, most tradable goods are all levied at the standard rate, with the exception of basic foods, which are mainly unprocessed and largely produced in the agricultural sector.

In South Africa, a consumption-type VAT at 14% was introduced in 1991 to replace the General Sales Tax. The basic foods that are tax exempt account for approximately 15% of household tradable consumption expenditures.[18] A substantial portion of non-tradable goods and services, including medical services, education, and social services, and imputed services provided by owner-occupied houses are exempt.[19] As a consequence, input taxes paid on these activities are not creditable and hence are passed forward to final consumers in higher prices. The tax is, in fact, hidden and is eventually reflected in the effective tax rate of non-tradable goods and services. Thus, the average effective VAT rate is expected to be lower for non-tradable goods than for tradable goods.

It should also be noted that estimates of the above weighted average of the effective VAT rates for tradables and non-tradables may still be lower than the average effective VAT rate calculated from the actual tax collections. This is due to the fact that we have not taken into account the informal economy, the lack of administrative capacity to handle

[18]This is based on 1998 South African Household Expenditure Survey. However, this ratio has declined to 8.8% (Statistics South Africa, 2008).

[19]The only taxable services include restaurants, hotel and other accommodation, telecommunication services, some retail services, and professional fees provided by lawyers, accountants, engineers, architects, etc. These taxable services constitute about 20% of all non-tradable household consumption expenditures.

large volumes of tax returns, exemptions from compulsory VAT registration, and evasion by taxpayers. This implies a low compliance rate in many developing countries,[20] and a potential tax compliance ratio must be accounted for.

Given the relative sizes of tradables and non-tradables at 67% and 33%, as previously presented, we can express the average effective VAT rate for a country as the weighted average of the effective tax rates for tradables and non-tradables by incorporating the potential compliance rate for the tax system. With the statutory rate of 14% in South Africa, the effective VAT rate is estimated at about 12.88% (v_t) for tradables and 8.40% (v_{nt}) for non-tradables.

In addition, we are dealing with two operations in the general equilibrium analysis setting: funds extracted from the capital market, and the substitution effects on the quantities demanded and supplied in response to the real exchange rate. The incidence of a consumption-type VAT will be borne through the consumption portion of the demand for goods, because taxes paid on intermediate inputs and capital goods purchased by businesses are all refundable. For South Africa, we estimate that the proportion of the change in demand that is excluded from VAT as a consequence of the capital extraction operation (ρ_i) is approximately 85%. In the case of the substitution effect, the coefficient (ρ_s) is estimated at 60%, based on the ratio of the sum of intermediate inputs plus capital investment to the total output for 1998.[21]

[20] See., e.g., Jenkins and Kuo (2000).
[21] This was about 59.2%, estimated from Statistics South Africa (1998), Table 4: Use of Products at Purchasers' Prices.

Excise Tax or Duty

In most countries covered by this study there is a set of excise taxes or duties that are levied on selective commodities at a single stage with ad valorem rates or specific unit rates. These products generally include soft drinks, bottled water, alcoholic beverages, cigarettes and tobacco products, motor vehicles, petroleum products, and cosmetics. The list can be long, depending upon the tax laws in specific countries. These selective commodities are all tradable and mainly purchased for household final consumption.[22]

The excise tax or duty is generally levied on import duty-paid value, if imported, or at the factory gate, if produced locally. However, for some products in certain countries it is imposed at wholesale or retail levels. With the general hypothesis of fully shifted forward sales tax, we estimate the effective excise tax or duty (t_e) for South Africa to be 6.06%, based on the household final consumption expenditures. This treatment is equivalent to the tax based on import duty-paid value.[23]

Export Tax

For some countries, export taxes are imposed on a few commodities in order to generate more tax revenues or to protect certain processing industries.[24] The effective export tax rate is calculated as the ratio of the total export tax revenue to the total FOB (free on board) value of exports. No export tax is imposed on exported goods in South Africa.

[22]Even if they are purchased for business purposes, e.g. motor vehicles or fuel, they are generally not creditable like the VAT system. However, if they are, they should be treated in the same fashion as in the VAT system.

[23]As these selective excisable commodities are all tradable, the effective excise tax rate estimated here is based on tradable consumption expenditures alone. The effective excise tax rate on non-tradable goods and services is virtually zero.

[24]For example, Ivory Coast is the largest cocoa-producing country in the globe. It imposes export tax on cocoa. The tax generates a substantial amount of the government's revenue.

Production Subsidy

In some countries, subsidies are provided to enterprises, resident producers or importers (African Development Bank, 2010). Subsidies use up additional resources to enable producers to compete in domestic or international markets. The effective subsidy rate is calculated by taking the total amount of subsidies and dividing it by GDP (gross domestic product) at factor cost, with the assumption that subsidies are provided equally between tradable and non-tradable good sectors. For South Africa, it was estimated at about 0.40%.

4.2 The FEP and the NTP for South Africa

Given the estimates for the sourcing of funds, the proportions of tradable and non-tradable goods, demand elasticities for tradables and imports, and the supply elasticities of tradables and exports, together with the effective tax and subsidy rates presented in the previous section, we can substitute these parameters into the equations presented in Sections 3.1 and 3.2 to generate the FEP and the NTP for South Africa. Their values would be approximately 6.41% and 0.63%, respectively, as shown in Table 1.

Table 1: Summary of Externalities for South Africa (%)

	Domestic capital source	Foreign capital source	Capital market weights
Funds spent on tradable goods	8.66	0.00	6.41
Funds spent on non-tradable goods	2.88	−5.78	0.63

Here, a sensitivity analysis is performed. As previously discussed, the sourcing of funds at the margin is likely to be sensitive to the supply elasticity of the stock of foreign capital with respect to the interest rate. If the supply elasticity of foreign capital is increased from 1.5 to 2.0, the proportion of funds sourced abroad would increase from 26% to 32%, and from the domestic capital market it would decline from 74% to 68%. Other things being equal, of the 68% sourced from domestic savings, 10.6% would come from stimulated household savings and 57.5% from displaced investment. This suggests that the FEP and the NTP would be lowered to 5.89% and 0.11%, respectively.

From the above analyses, we conclude that the FEP for South Africa would be approximately 6.25% and the NTP would be 0.50%. These estimates are slightly higher than the previous estimates owing to a number of factors, including the levels of the effective VAT rates for tradable and non-tradable goods, the excise duty rate for tradable goods, the elasticities of demand and supply of importable and exportable goods, and the percentage exclusion from VAT during the exchange rate effect.[25]

4.3 The FEP and NTP for Other African Countries with a VAT System

We follow the general procedure established in the previous section for South Africa to estimate the key parameters or assumptions used to measure the FEP and the NTP for a number of countries that have a consumption-type VAT. For example, estimating the sourcing of funds at margin would require the average proportion of saving ratios for domestic and foreign savers, the ratio of the private-sector investment to total savings, and the demand and supply elasticities of funds with respect to the cost of capital raised

[25]One of the reasons for the difference is that in the previous study, the effective excise duty rate for tradable goods was in fact based on the total household consumption expenditures including tradable as well as non-tradable goods. It was biased downward in terms of the distortions associated with the tradable good sector. See Harberger *et al*. (2003).

in the capital market of each country. We calculate the average ratio of gross savings from nationals to gross fixed capital formation as a proxy for the ratio of domestic savings to total private-sector savings. The average private-sector investment saving ratio would depend on the financial situation in each country. In the case of sources of funds required for projects, it is assumed that the supply elasticity of funds for household savers is 0.4, for foreign savers 2.0, and for the demand elasticity of investment −1.0. The result of this parameter $(\partial F^D / \partial F)$ for each country is estimated and is shown in the second column of Table 2.

Second, we have assumed that for each country in this study the displaced demand for tradable goods by borrowing funds domestically $(\partial Q_{d,t} / \partial F^D)$ for investment projects is 67% and for non-tradable goods 33%. The demand for importables as a share of total demand for tradables in an economy is assumed to be 80%, while the supply of importables as a share of total supply of tradables is 40%. This implies that the compensated own-price elasticity of demand for imports must be −3.00 and the own-price supply elasticity of exports 2.00 if the compensated own-price elasticities of demand for importables and exportables are −1.00 and the price elasticities of importables and exportables are 1.00. In the case of assessing the displaced importables as a share of total demand for tradables during the process of extracting capital domestically, we take into consideration the different capacity for manufacturing durable goods, such as machinery, transportation and electric equipment, motor vehicles, and iron

and steel, in each country. This parameter $(\partial Q_{d,i} / \partial Q_{d,t})$ is presented in the third column of Table 2.[26]

As in the case of South Africa, we have assumed that the proportion of exclusion from the VAT for investment purpose is 85% in the process of capital market extraction. In the case of general business that is due to the substitution effect, the exclusion from VAT is assumed to be 60%.[27]

The most important distortions affecting the FEP and the NTP include the rates of import duty, export tax, VAT, excise tax, and subsidies provided by governments to producers. These vary considerably across countries. Annual effective tax and subsidy rates are calculated for the past few years for each country, and the simple average rate in the latest two to three years for which data are available are shown in columns 4 to 9 of Table 2.

Substituting these parameters into the equations presented in Sections 3.1 and 3.2 enables us to generate estimates of the FEP and the NTP for each country. These estimates are presented in the last two columns of Table 2.

[26] For example, the parameter for Kenya, 0.92, is calculated as a weighted average of importables as a share of total demand for tradables of both household consumption expenditures and business investment (i.e. 15%*0.80 + 85%*0.95).

[27] It can be argued that the exclusion from VAT should be lower at, say, 55%, owing to a higher contribution of capital to production in countries that are less developed than South Africa. This would raise the estimated FEP marginally by 0.5 to 0.75%. For example, the FEP for Kenya would be 8.70% instead of 8.65%.

Table 2: Parameters and Effective Tax Rates for Countries with a VAT System (%)

Countries	Parameters		Effective tax and subsidy rates						Premiums	
	Fund sourcing	Capital extraction							FEP	NTP
(1)	$\partial F^D / \partial F$ (2)	$\partial Q_{d,i} / \partial Q_{d,t}$ (3)	t_m (4)	t_x (5)	v_t (6)	v_{nt} (7)	t_e (8)	k_t (9)	(10)	(11)
Ethiopia	0.74	0.92	7.00	0.00	8.05	1.89	2.25	0.26	6.64	−0.24
Ghana	0.68	0.92	8.50	0.42	9.34	2.20	3.64	0.06	7.87	−0.86
Ivory Coast	0.76	0.92	14.33	5.33	4.61	1.09	1.15	0.78	9.50	+1.54
Kenya	0.72	0.92	4.90	0.06	11.54	2.72	7.21	0.04	8.65	−0.57
Madagascar	0.60	0.92	11.00	0.00	7.74	1.82	2.70	0	7.76	−1.82
Mali	0.64	0.92	7.77	0.00	11.66	2.74	3.79	0.93	7.39	−1.50
Mauritius	0.76	0.89	3.79	0.00	12.75	3.00	2.94	0.52	5.71	−0.35
Morocco	0.72	0.92	4.00	0.00	16.52	4.00	7.12	3.54	8.62	−0.73
Nigeria	0.60	0.89	4.11	0.00	3.75	0.88	0.4	0	2.52	−0.77
Rwanda	0.70	0.92	5.80	0.00	7.76	1.83	2.70	4.89	5.86	−0.52
Senegal	0.64	0.92	6.09	0.00	14.66	3.45	3.37	5.85	7.91	−1.68
Tanzania	0.68	0.92	3.75	0.00	14.08	3.31	0.54	0	3.94	−0.80
Togo	0.58	0.92	8.09	0.08	9.34	2.20	1.67	1.72	5.55	−1.79
Tunisia	0.82	0.92	2.40	0.06	13.70	3.22	5.76	2.58	7.18	+0.12
Uganda	0.76	0.92	4.10	0.05	8.29	1.95	0.05	0	8.46	0.00
Zambia	0.76	0.92	5.00	0.00	10.03	2.36	5.04	0.37	7.66	−0.05

5. THE FEP AND THE NTP FOR COUNTRIES WITH A GENERAL SALES TAX SYSTEM

This section is concerned with countries that do not have a VAT system. Unlike VAT jurisdictions, these countries implement a general sales tax system with no credit provided to vendors on their business inputs. However, some countries such as Egypt provide a partial tax credit to certain sectors. The incidence of these tax systems will

differ from that which was described in the previous section. In this section we will deal with three countries, Egypt, Seychelles and Democratic Republic of Congo.

Egypt

The General Sales Tax in Egypt was first introduced in 1991 to replace Consumption Tax. It was then extended from the manufacture sales tax to wholesale and retail levels. Part of the tax paid on intermediate inputs is allowed as a tax credit, and the zero-rating of exports is also permitted. However, no credit is allowed for the purchase of capital assets. It is one step short of becoming a consumption-type VAT. As a result, some tax-cascading effect prevails in the system, and this must be taken into account when measuring the FEP and NTP.

Moreover, the General Sales Tax in Egypt has multiple rates. The standard rate levied on taxable goods is 10%. A reduced rate of 5% is applied to foodstuffs and fertilizers; a higher rate of 25% is levied on televisions, radios, jewellery, and some vehicles; and a still higher rate of 30% is imposed on luxury items such as cosmetics, video cameras, and expensive vehicles. As in VAT jurisdictions, exemptions from the General Sales Tex include basic food and medicine, equipment for national defence and security, and scientific, educational and cultural products imported for use by scientific research institutions.

Given the general assumption of a fully forward shifting of the sales taxes to final consumers, all cascading effects that are the result of the absence of credit provided to business purchase of capital goods or tax exemptions are assumed to be spread over the final household consumption expenditures in the form of higher prices of goods and

services.[28] Using these assumptions, it is possible to estimate the effective General Sales Tax rates for tradable and non-tradable goods.

With a partial credit under the General Sales Tax, the proportions of exclusions from the General Sales Tax during the capital market extraction and for general business purpose are estimated to be approximately 74% and 52%, which are lower than the 85% and 60% used for the previous simulations with a VAT system.

Seychelles

Seychelles is a country spanning an archipelago of 115 islands in the Indian Ocean. It previously operated a Goods and Services Tax that was levied on locally manufactured goods and services at 15%, with some reduced rates on specific services.[29] However, on September 6, 2012 the Minister of Finance, Trade and Investment announced that on January 1 2013, VAT would be introduced to replace the Goods and Services Tax. For the purpose of this study, we assume the country will implement a VAT system.

Since Seychelles is an island economy, it is heavily dependent upon tourism. It was likely that goods and services related to the tourism sector would be taxed under a proposed VAT system. Exemption may be limited to unprocessed food, education, and health and social welfare services. We assume that the tradable good sector in this island economy accounts for 75%, rather than the 67% assumed for the other African countries previously mentioned. Furthermore, it is assumed that only 10% of tradable goods are tax exempt

[28]The cascading is assumed to be about 15% of the total tax burden on final consumers. This is based on a study relating to a tax system similar to the General Sales Tax in Egypt. In Canada's former federal sales tax system, the tax proved to be a hidden indirect manufacturer's sales tax embodied in the value of final consumption and exported goods. See, e.g., Kuo *et al*. (1988).

[29] For example, 5% is imposed on services provided by dentists and opticians, while the services of property management businesses and tour operators are subject to 6%.

because of the effective control at customs, while in the case of non-tradables, the figure is assumed to be 40%.

For the purpose of this study we assume that the sales tax reform in Seychelles will be a revenue-neutral scenario, and thus that it will be operated at a single tax rate of 15%. The effective tax rate can then be estimated to be around 13.5% for tradable goods (gst_t) and 9.0% for non-tradable goods (gst_{nt}).

Democratic Republic of Congo

A Turnover Sales Tax is applied to imported goods and locally produced goods in the Democratic Republic of Congo. The current general tax rate is 13%. Assuming that the Turnover Sales Tax would be shifted forward to final consumers, there would be a tax-cascading effect owing to the absence of tax credit provided to vendors for business use.

The effective tax rate was 3.94% in 2007. We assume that the cascading effect is about 30% embodied in the effective tax rate.[30] This implies that a tax of 0.91% is being hidden in the system or embodied in higher prices of final consumption of goods and services. With this measure, we can estimate the effective sales tax rate at 4.96% for tradable goods (gst_t) and 1.86% for non-tradable goods and services (gst_{nt}).

Since no credit is provided to vendors for business use, there is no exclusion from the Turnover Sales Tax during the initial capital extraction or other business purpose.

[30] This is based on the estimates experienced in the manufacturing sales tax system in Canada, which has the same features as the tax system in the Democratic Republic of Congo (Kuo *et al*., 1988).

The effective general sales tax rates described above for the three countries, together with estimates of other effective excise tax and subsidy rates and parameters, are shown in Table 3. In order to measure the FEP and the NTP, we substitute these tax rates and parameters into the equations in Sections 3.1 and 3.2. The results are presented in the last two columns of Table 3.

Table 3: Parameters and Effective Tax Rates for Countries with the General Sales Tax System (%)

Countries	Parameters		Effective tax and subsidy rates						Premiums	
	Fund sourcing	Capital extraction							FEP	NTP
	$\partial F^D / \partial F$	$\partial Q_{d,i} / \partial Q_{d,t}$	t_m	t_x	gst_t	gst_{nt}	t_e	K_t		
Egypt	0.78	0.92	4.00	0.18	6.20	1.93	2.00	8.93	5.07	+0.47
Seychelles	0.73	0.92	3.19	0.00	13.50	9.00	4.36	0.00	6.23	+0.72
Democratic Republic of Congo	0.65	0.92	7.71	0.44	4.96	1.86	1.50	0.00	7.78	+0.81

6. CONCLUDING REMARKS

This paper has developed an analytical framework and a practical approach to the measurement of the FEP and the NTP for an economy. Owing to the existence of indirect taxes and production subsidies involved in both domestic and external transactions, the FEP reflects the difference between the economic value of foreign exchange and the market exchange rate. Likewise, an NTP is generated because of the set of tax and subsidies that cause the shadow price of non-tradable goods to be greater or less than their financial values. To measure these premiums, the economic welfare effects of the

sourcing of the funds from the capital market to finance the purchase of project inputs, as well as the economic welfare effects that are due to changes in the pattern of consumption and production caused by the adjustment of the real exchange rate, are taken into account in a general equilibrium setting.

Given the resource constraints facing the countries of Africa, a general equilibrium analysis is the most appropriate approach for estimating these premiums. Securing the data for the estimation is a challenge. Most of the African countries have focused their data collection efforts on the supply side of the economy, not on the demand or expenditure patterns. Nevertheless, we have developed detailed data for South Africa that provide a general guide for other countries for distortions such as import duty, VAT or other general sales tax, excise tax, export tax, and production subsidies that are specific to each individual country. As better information becomes available, use of the theoretical framework and the Excel-based simulation model[31] should facilitate the calculation of more accurate estimates.

The estimates of the FEPs and the NTPs of 20 countries carried out by this study are summarized in Table 4. The FEP ranges from 2.5% to 9.50%. If we exclude Nigeria, the range becomes 4.00% to 9.5%. The NTP ranges from −1.75% to 1.50%. The magnitudes of the premiums depend upon the key distortions prevailing in the various indirect taxes and production subsidies provided to producers. They also depend not only on the consumption patterns and the economic structure of the economy, but also on the response of demand and supply of tradable and non-tradable goods to changes in the real exchange rate.

[31] The simulation model is available from the authors on request.

One of the other most important factors affecting the sizes of the premiums is the degree of openness of an economy with respect to the movement of capital across its borders. To ensure the robustness of the estimates, sensitivity analysis is generally carried out. In any event, the FEP and the NTP estimated in this paper are robust and should be used in the economic evaluation of investment projects in the countries concerned.

Table 4: Estimates of the FEP and the NTPs in African Countries (%)

Country	FEP	NTP
Democratic Republic of Congo	7.75	0.75
Egypt	5.00	0.50
Ethiopia	6.50	−0.25
Ghana	8.00	−1.00
Ivory Coast	9.50	1.50
Kenya	8.50	−0.50
Madagascar	7.75	−1.75
Mali	7.50	−1.50
Mauritius	5.75	−0.25
Morocco	8.50	−0.75
Nigeria	2.50	−0.75
Rwanda	6.00	−0.50
Senegal	8.00	−1.50
Seychelles	6.25	0.75
South Africa	6.25	0.50
Tanzania	4.00	−0.75
Togo	5.50	−1.75
Tunisia	7.00	0.00
Uganda	8.50	0.00
Zambia	7.50	0.00

APPENDIX A

The Impact of Funds Sourced in the Domestic Market

To Purchase Tradables Subject to Domestic Indirect Taxation

Given the resource constraint and the national expenditures in an economy, equation (A1), which is the same as equation (5), must hold in equilibrium including additional spending by the project in question. That is,

$$Q_d = Q_{d,t}E + Q_{d,nt} + Q_{d,t}^P E + Q_{d,nt}^P = Q_{s,t}E + Q_{s,nt} = Q_s \qquad \text{(A1)}$$

Differentiating equation (A1) with respect to funds (dF^D) being raised in the domestic capital market and spent totally on tradable goods $\left(i.e. \partial Q_{d,t}^P / \partial F^D = 1\right)$ yields:

$$\left[\left(1 + \frac{\partial Q_{d,t}}{\partial F^D} - \frac{\partial Q_{s,t}}{\partial F^D}\right)(E) + \left(\frac{\partial Q_{d,nt}}{\partial F^D} - \frac{\partial Q_{s,nt}}{\partial F^D}\right)dF^D\right] +$$
$$\left[\left(\frac{\partial Q_{d,t}}{\partial E} - \frac{\partial Q_{s,t}}{\partial E}\right)(E) + \left(\frac{\partial Q_{d,nt}}{\partial E} - \frac{\partial Q_{s,nt}}{\partial E}\right)\right]\left(\frac{\partial E}{\partial F^D}dF^D\right) = 0 \qquad \text{(A2)}$$

The size of the change in the real exchange rate that is due to the domestic borrowing and spending on the project is determined by the size of the gap between the demand and supply of tradable goods (dG_t) that has been created by the two operations. Thus, the last term of equation (A2) can be expressed as:

$$\frac{\partial E}{\partial F^D}dF^D = \frac{\partial E}{\partial G_t}\frac{\partial G_t}{\partial F^D}dF^D \qquad \text{(A3)}$$

where $\frac{\partial G_t}{\partial F^D} = 1 + \frac{\partial Q_{d,t}}{\partial F^D}$. The impact on the real exchange rate from an increase in the gap (dG_t) or the excess demand for tradable goods can be expressed as a function of the price demand and supply elasticity of tradable goods as follows:

$$\frac{\partial E}{\partial G_t} = \frac{\frac{\partial Q_{d,t}}{\partial F}\left(\frac{E}{Q_{d,t}}\right)}{\left(\varepsilon_t^s - \eta_t^d\right)} \tag{A4}$$

Substituting equations (A3) and (A4) into equation (A2) yields:

$$\left[\left(1_t + \frac{\partial Q_{d,t}}{\partial F^D}\right)(E) + \left(\frac{\partial Q_{d,nt}}{\partial F^D}\right)\right] dF^D + \left[\left(\frac{\partial Q_{d,t}}{\partial E} - \frac{\partial Q_{s,t}}{\partial E}\right)(E) + \left(\frac{\partial Q_{d,nt}}{\partial E} - \frac{\partial Q_{s,nt}}{\partial E}\right)\right]\left(\frac{\frac{\partial Q_{d,t}}{\partial G_t}\frac{E}{Q_{d,t}}}{\varepsilon_t^s - \eta_t^d}\right)\left(1 + \frac{\partial Q_{d,t}}{\partial F^D}\right) dF^D = 0 \tag{A5}$$

Expressing the demand and supply function variables in equation (A5) in terms of the demand and supply elasticities of tradable and non-tradable goods, equation (A5) can be expressed as follows:

$$\left[\left(1_t + \frac{\partial Q_{d,t}}{\partial F^D}\right)(E) + \left(\frac{\partial Q_{d,nt}}{\partial F^D}\right)\right] dF^D + \left[\left(\eta_t^d \frac{Q_{d,t}}{E} - \varepsilon_t^s \frac{Q_{s,t}}{E}\right)(E) + \left(\eta_{nt}^d \frac{Q_{d,nt}}{E} - \varepsilon_{nt}^s \frac{Q_{s,nt}}{E}\right)\right]\left(\frac{\frac{\partial Q_{d,t}}{\partial G_t}\frac{E}{Q_{d,t}}}{\varepsilon_t^s - \eta_t^d}\right)\left(1 + \frac{\partial Q_{d,t}}{\partial F^D}\right) dF^D = 0 \tag{A6}$$

Since $\partial Q_{d,t} / \partial G_t = 1$, rearranging equation (A6) gives:

$$\left[\left(1_t+\frac{\partial Q_{d,t}}{\partial F^D}\right)(E)+\left(\frac{\partial Q_{d,nt}}{\partial F^D}\right)\right]dF^D+\left[\frac{\left(\eta_t^d-\varepsilon_t^s\right)E+\left(\eta_{nt}^d-\varepsilon_{nt}^s\right)\left(\frac{Q_{d,nt}}{Q_{d,t}}\right)}{\varepsilon_t^s-\eta_t^d}\right]\left(1+\frac{\partial Q_{d,t}}{\partial F^D}\right)dF^D=0$$

(A7)

The terms in equation (A7) can be used to quantify the shifts in the equilibrium quantities of tradable and non-tradable goods and the impacts of these shifts on the domestic indirect taxes that are due to both the impact of the borrowing in the domestic capital market and the adjustment of the real exchange rate. As a consequence, the welfare effects that are due to distortions in domestic indirect taxes from these two operations can be measured as expressed by equations (3) and (9).

APPENDIX B

The Impact of Funds Sourced in the Domestic Market

To Purchase Tradable Goods on Import and Export Taxes

There will be changes in the equilibrium quantities of imports and exports in the economy that are due to the domestic borrowing and purchase of tradable goods. Since the external sector involves a distinct set of distortions, changes in economic welfare cost from this source should also be accounted for while measuring the total change in the economic welfare in the economy. In order to assess the impacts of sourcing the funds domestically and spending them on tradables, it is necessary to separate the demand for and supply of traded goods into importable and exportable components. Hence, equation (A1) can be expressed as follows:

$$Q_d = \left(Q_{d,i} + Q_{d,e}\right)E + Q_{d,nt} + \left(Q^P_{d,i} + Q^P_{d,e}\right)E + Q^P_{d,nt} = \left(Q_{s,i} + Q_{s,e}\right)E + Q_{s,nt} = Q_s \qquad \text{(B1)}$$

Differentiating equation (B1) with respect to (dF^D), the funds being raised in the domestic capital market and spent totally on importable and exportable goods, yields:

$$\left[\left(1+\frac{\partial Q_{d,i}}{\partial F^D}+\frac{\partial Q_{d,e}}{\partial F^D}\right)(E)+\left(\frac{\partial Q_{d,nt}}{\partial F^D}\right)\right]dF^D + \left[\left(\frac{\partial Q_{d,nt}}{\partial E}-\frac{\partial Q_{s,nt}}{\partial E}\right)+\left(\left(\frac{\partial Q_{d,i}}{\partial E}-\frac{\partial Q_{s,i}}{\partial E}\right)-\left(\frac{\partial Q_{s,e}}{\partial E}-\frac{\partial Q_{d,e}}{\partial E}\right)\right)(E)\right]\frac{\partial E}{\partial G_t}\frac{\partial G_t}{\partial F^D}dF^D = 0$$

(B2)

Equation (B2) is exactly the same as equation (A2), except for the fact that tradable goods is now broken down into demand for and supply of importable and exportable goods. Using the demand and supply elasticities of importable goods, exportable goods, and non-tradable goods, equation (B2) can be expressed as follows:

$$\left[\left(1+\frac{\partial Q_{d,i}}{\partial F^D}+\frac{\partial Q_{d,e}}{\partial F^D}\right)(E)+\left(\frac{\partial Q_{d,nt}}{\partial F^D}\right)\right]dF^D + \left[\left(\eta^d_{nt}\frac{Q_{d,nt}}{E}-\varepsilon^s_{nt}\frac{Q_{s,nt}}{E}\right)+\left(\left(\eta_{d,i}\frac{Q_{d,i}}{E}-\varepsilon_{s,i}\frac{Q_{s,i}}{E}\right)-\left(\varepsilon_{s,e}\frac{Q_{s,e}}{E}-\eta_{d,e}\frac{Q_{d,e}}{E}\right)\right)(E)\right]\left(\frac{\frac{\partial Q_{d,t}}{\partial F^D}\frac{E}{Q_{d,t}}}{\varepsilon^s_t-\eta^d_t}\right)\left(1+\frac{\partial Q_{d,t}}{\partial F^D}\right)dF^D = 0$$

(B3)

Since $\partial Q_{d,t}/\partial F^D = 1$ and $Q_{d,t} = Q_{s,t}$, substituting the demand elasticity of imports for the demand and supply elasticity of importable goods as well as the supply elasticity of exports of the supply and demand elasticity for exportable goods into equation (B3) yields:

$$\left[\left(1+\frac{\partial Q_{d,i}}{\partial F^{D}}+\frac{\partial Q_{d,e}}{\partial F^{D}}\right)(E)+\left(\frac{\partial Q_{d,nt}}{\partial F^{D}}\right)\right]dF^{D}+$$
$$\left[\left(\eta_{nt}^{d}\frac{Q_{d,nt}}{Q_{d,t}}-\varepsilon_{nt}^{s}\frac{Q_{s,nt}}{Q_{s,t}}\right)+\left(\eta_{M}^{d}\frac{M}{Q_{d,t}}-\varepsilon_{X}^{s}\frac{X}{Q_{s,t}}\right)(E)\right]\left(\frac{1}{\varepsilon_{t}^{s}-n_{t}^{d}}\right)\left(1+\frac{\partial Q_{d,t}}{\partial F^{D}}\right) \quad \text{(B4)}$$

Equation (B4) can be used to quantify the shifts in the equilibrium quantities of demand for importable and exportable goods as well as non-tradable goods that are due to both the impact of the borrowing and the adjustment on the real exchange rate. As a consequence, the welfare effects resulting from distortions in import duty, excise tax on imported goods, and export tax from these two operations can be measured as presented in equations (10) and (11). It should be noted that changes in the demand and supply of non-tradable goods will not trigger any taxes in the external sector.

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