

The Economic Cost of Foreign Exchange for South Africa

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Abstract

In economic cost benefit analysis there is a need to choose a numéraire in which all costs and benefits are evaluated. In recent years the most common practice has been to express all costs and benefits in terms of domestic currency at the domestic price level. When this numéraire is chosen it is necessary to adjust all transactions that are made with international traded goods and involve foreign exchange to account for the divergence that arise between the financial cost of foreign exchange and its economic value. The purpose of this paper is to develop an analytical framework that will enable us to estimate the economic cost of foreign exchange for South Africa.

Keyword: Foreign Exchange, cost, VAT, South Africa

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1 Analytical Framework

Most empirical work on the estimation of the economic price of foreign exchange has been carried out using a partial equilibrium analysis. An exception is the study by Jenkins and Kuo for Canada that employed a multisectoral computable general equilibrium model.*⁽³⁾ In this case it was assumed that the financing of the purchase of foreign exchange was obtained by increasing income tax receipts. This assumption is not consistent with the estimation of the economic opportunity cost of capital, where it is the capital market that is postulated to be the source of funding for the project.

In a recent paper, Harberger and Jenkins developed a three sector general equilibrium framework to illustrate how the foreign exchange premium could be estimated in an economy in which the funds used to finance the purchase of tradable and non-tradable goods are obtained via the capital markets.*⁽⁴⁾ This framework ensures that all repercussions in the economy due to the purchase of tradable goods for a project are taken into account in a consistent manner.

The three sectors of this model consist of the demand for and production of importable, exportable and non-tradable goods and services. These markets contain tariffs, non-tariff barriers, sales and excise taxes, and subsidies. There is also a set of constraints on the quantity of resources available to the economy, and explicit consideration is given to how the purchase of foreign exchange or the non-traded goods for an investment are financed. For consistency with the other components of the project's evaluation, we estimate the premium of foreign exchange and the premium or discount for expenditures on non-traded goods using the same sources of funding as we identified in the estimation of the economic opportunity cost of capital. It is this approach that we use here for the estimation of these parameters for South Africa.

2 A General Equilibrium Model

South Africa is a small, open and developing country. When considering the marginal source of funds to finance investments almost always the marginal source of funds for both the public and private sectors is capital market borrowing. When a project is financed by extractions from the capital market there are three ultimate sources for these funds. Some would have been invested in other investment activities, some would have been spent on private consumption, and some are sourced from foreign savers via capital inflows. In the analysis that follows we wish to evaluate the externalities associated with the purchase of (a) traded and (b) non-traded goods and services that are financed through capital market borrowings. Different sets of the external effects will be involved, depending on the particular sources (*e.g.*, domestic vs. foreign) from which the funds were drawn and the types of expenditures made (traded vs. non-traded).

In the analysis that follows we consider four cases: (i) funds sourced in the domestic capital market that are used to purchase internationally traded goods, (ii) funds sourced in the domestic capital market that are used to purchase domestic (non-traded) goods, (iii) funds sourced from foreign savers that are used to purchase internationally traded goods, and (iv) funds sourced from foreign savers that are used to purchase domestic (non-traded) goods.

We will begin with a discussion using the local capital market sourcing to finance the inputs required by a project.

(a) Domestically Sourced Funds Used to Purchase Inputs

We begin by aggregating all the goods and services purchased and consumed in the economy into three categories, importable goods, exportable goods, and non-tradable goods. Importable goods include actual and potential domestic substitutes for imports.

Exportable goods include export-type goods or services that are produced and consumed domestically. The domestic prices of tradables are taken to be fundamentally determined by the world prices of the products in question, modified by transport costs, tariffs and other distortions. Non-tradable goods are goods produced domestically that are neither importable nor exportable, *i.e.*, goods whose internal prices are determined by the equilibrium of domestic supply and demand.

When funds are extracted from the domestic capital market to finance the purchase of imported goods, the sources of domestic funds could be either displaced investment or forgone consumption, which are in turn made up of importable goods, exportable goods and non-tradable goods. Suppose the amount of

capital raised in the domestic market is dB . This money would come to the project accompanied by a reduction of spending on the three composite goods in the economy, *i.e.*, importable goods ($Q_{d,i}$), exportable goods ($Q_{d,e}$), and non-tradable goods ($Q_{d,nt}$) as shown below:

$$dB = -(\partial Q_{d,i} / \partial B) dB - (\partial Q_{d,e} / \partial B) dB - \partial Q_{d,nt} / \partial B) dE \quad (1)$$

Funds Raised in Domestic Capital Market And Used only to Purchase Importable Goods

The extraction of funds *via* the capital market and its entire expenditure on importable goods results in a net positive demand for tradable goods - by the amount of $[dB + (\partial Q_{d,i} / \partial B)dB + (\partial Q_{d,e} / \partial B)dB]$ - but a net reduction in the demand for non-tradable goods - in the amount of $(\partial Q_{d,nt} / \partial B)dB$. This disequilibrium will cause the exchange rate (defined as Rands per US dollar) to rise, causing the price of tradable goods to increase, while the relative price of non-tradable goods will decrease. As a consequence of these changes in relative prices of tradable goods to non-tradable goods, the domestic demand for importable goods and exportable goods will decline; and that for non-traded goods will rise. At the same time, the producers of importable and exportable goods will find it more profitable to produce, and producers of non-tradable goods will wish to produce less.

We choose units of the goods for these three sectors such that the initial prices of goods in all three sectors are equal to one. Then the above respective demand and supply adjustments in terms of substitution effects between tradable and non-tradable goods in order to reach a new equilibrium can be expressed as follows:

$$(\partial Q_{d,i} / \partial E) dE + (\partial Q_{d,e} / \partial E) dE + (\partial Q_{d,nt} / \partial E) dE = 0 \quad (2)$$

where E stands for foreign exchange rate. The elements in equation (2) must sum to zero in order for there to be no excess demand in the system at the new equilibrium. Similarly, the changes in the supply of the three sectors due to the change in the exchange rate must sum to zero in order for the current employment status of factors to remain unchanged. That is:

$$(\partial Q_{s,i} / \partial E) dE + (\partial Q_{s,e} / \partial E) dE + (\partial Q_{s,nt} / \partial E) dE = 0 \quad (3)$$

where $Q_{s,i}$, $Q_{s,e}$ and $Q_{s,nt}$ stand for the supply of importable, exportable and non-tradable goods, respectively.

Equations (2) and (3) can be expressed in terms of elasticities of demand and supply of importable, exportable, and non-tradable goods with respect to changes in the foreign exchange rate. This implies that the weighted sum of all the compensated price elasticities of demand (and supply) across all of the goods will always be equal to zero. They are:

$$(h_i Q_{d,i} + h_e Q_{d,e} + h_{nt} Q_{d,nt}) (dE/E) = 0 \quad (2a)$$

$$(e_i Q_{s,i} + e_e Q_{s,e} + e_{nt} Q_{s,nt}) (dE/E) = 0 \quad (3a)$$

When the money raised in the capital market is spent on importables, these mechanisms imply a net increase in the supply of importable and exportable goods. The adjustment of the exchange rate will ensure that there is no excess supply in the tradable goods market when a final equilibrium is reached.

In the non-tradable goods market, the reduction in demand because of the initial capital extraction is somewhat offset by an increase in the quantity demanded due to the decrease in the relative prices of non-tradable to tradable goods. The supply of non-tradable goods responds to the depressed market by contracting. Given our assumption of maintaining the current employment status where the economy is producing on its current (perhaps inefficient) production possibility frontier, resources that are released from the non-tradable goods sector will be used to produce goods to meet the increased demand in the tradable goods sector. These adjustments will continue until a final equilibrium is re-established. At the new equilibrium, the total resources released from the non-tradable goods sector must equal the resources required for the additional production of importable and exportable goods.

The extraction of funds *via* the capital market results in a reduction in demand in both the tradable and non-tradable sectors. Because in this case these funds are spent entirely on tradable goods a disequilibrium situation is created in both markets. To achieve equilibrium in the non-tradable goods sector (which implies equilibrium in the tradable goods market as well) there will be an induced increase in the demand for non-tradable goods (substitution effect) due to the fall in their relative price plus a simultaneous induced reduction in their supply. These two impacts together will offset the initial reduction in demand caused by the capital market action. This is shown in equation (4).

$$\left(\frac{\partial Q_{d,nt}}{\partial B} \right) dB + \left(\frac{\partial Q_{d,nt}}{\partial E} \right) dE + \left(\frac{\partial Q_{s,nt}}{\partial E} \right) dE = 0 \quad (4)$$

Given the definition of demand and supply elasticities of non-tradable goods, equation (4) can be rearranged and expressed as follows:

$$\begin{aligned} dE/E &= [(\eta_{Q_d,nt}/\eta_B)/(-h_{nt}Q_{d,nt} + e_{nt}Q_{s,nt})] dB \\ &= \{(\eta_{Q_d,nt}/\eta_B)/[-h_{nt}q_{d,nt} + (e_{nt}q_{s,nt})(Q_s/Q_d)]\}(dB/Q_d) \\ &= a(dB/Q_d) \quad (5) \end{aligned}$$

where $q_{d,nt}$ stands for the share of demand for non-tradable goods, $q_{s,nt}$ for the share of the supply of non-tradable goods, and Q_d and Q_s are the total demand for and the total supply of tradable plus non-tradable goods, respectively. The coefficient “a” measures the impact of an increase in demand for imports (dM) financed through the capital market ($dB=dM$) and the change in the relative price of tradable to non-tradable goods. This is the change in the real exchange rate (dE/E) due to an increase in demand for foreign exchange. The numerator of the coefficient is a change in the demand for non-tradable goods due to capital extraction while the denominator is the net change in demand for non-tradable goods as a result of the substitution effects [*i.e.*, equations (2a) and (3a)]. This relationship implies that in a general equilibrium setting, the impact of the demand for importable goods on the real exchange rate depends not only on capital extraction in the non-traded goods sector, but also on the substitution effects on demand and supply responses of the non-tradable goods caused by the change in relative prices.

In the case where funds are raised in the domestic capital market and spent on exportable goods, the impact on the exchange rate is exactly the same as the case where funds are spent on the purchase of importable goods because funds are all used to purchase foreign exchange.

Funds Raised in Domestic Capital Market And Spent on Non-Tradable Goods

In this case, there is an excess demand for non-tradable goods - $[dB + (\eta_{Q_d,nt}/\eta_B) dB]$ - as a net result of the capital extraction and the spending of the funds. At the same time, there is a reduction of spending on tradable goods because of the extraction of funds via the capital market. As a consequence, an increase in the relative price of non-tradable to tradable goods will force resources to be released from tradable goods production and reemployed in the non-tradable goods sector until a new equilibrium is re-established. The adjustment process is the reverse to that described in the case of funds spent on importable goods. The condition for an equilibrium to exist in the economy that was expressed in equation (4) is now modified to become:

$$(\eta_{Q_d,nt}/\eta_B) dB + dB + (\eta_{Q_d,nt}/\eta_E) dE - (\eta_{Q_s,nt}/\eta_E) dE = 0 \quad (6)$$

This can be rearranged to become:

$$\begin{aligned} dE/E &= [(1 + \frac{Q_{d,nt}}{B}) / [-h_{nt}Q_{d,nt} + (e_{nt}Q_{s,nt})(Q_s/Q_d)]] (dB/Q_d) \\ (7) \\ &= j (dB/Q_d) \end{aligned}$$

(b) Foreign Funds Used to Purchase Inputs for Project

When foreign funds are used to finance the project, the results are quite different from the case where local funds are raised and spent on project inputs. In this case, there is no initial displacement of investment and consumption of tradable and non-tradable goods due to the capital extraction. That is, $(\frac{Q_{d,i}}{B}) dB = 0$, $(\frac{Q_{d,e}}{B}) dB = 0$, and $(\frac{Q_{d,nt}}{B}) dB = 0$.

When funds come from abroad to purchase tradable goods, there is no excess demand for foreign or domestic currency. However, if these funds are spent on non-tradable goods, they need to be converted to local currency first. The additional demand for non-tradable goods will increase the relative prices of non-traded to tradable goods, thereby depressing the demand for other non-tradable goods. At the same time, the supply of non-tradable goods will increase and the supply of tradable goods will decrease. The adjustments will continue until an equilibrium is reached in the non-traded goods sector where the excess demand has to be zero.

$$\text{That is, } dB + (\frac{Q_{d,nt}}{E}) dE - (\frac{Q_{s,nt}}{E}) dE = 0$$

(8)

which can be written as follows:

$$\begin{aligned} dE/E &= [-h_{nt}Q_{d,nt} + (e_{nt}Q_{s,nt})(Q_s/Q_d)]^{-1} (dB/Q_d) \\ &= w (dB/Q_d) \end{aligned} \quad (9)$$

Equations (5), (7) and (9) show that funds raised from the domestic and foreign markets will have different effects on the real exchange rate (via a , j and w). When an equilibrium is re-established, the effects on the demand and supply of tradable and non-tradable goods in the economy can be estimated from each component of equations (2a) or (3a) such as $(h_i Q_{d,i}) (dE/E)$ for the impact on the demand for importable goods and $(e_i Q_{s,i}) (dE/E)$ for the supply of importable goods.

(c) Estimation of Externalities

The tax and subsidy distortions present in the market for importable goods can be classified into four categories - import tariffs and non-tariff barriers,*(5) export subsidies, VAT taxes, and other indirect taxes. The first set of externalities caused by the import tariffs (r_1) can be measured by the ratio of the amount of forgone tariff revenues to the market value of imports caused by this action. The value of imports to importers is measured by the price inclusive of tariffs. This can be calculated by including the displacement of importables due to the funds extracted from the capital market and the

net changes of demand and supply of importables as a result of the substitution effect:

$$r_1 = [(\frac{Q_{d,i}}{B}) dB + (h_i Q_{d,i} - e_i Q_{s,i}) (dE/E)] (t/dB) \\ = \{(\frac{Q_{d,i}}{B}) + a[h_i q_{d,i} - (e_i q_{s,i}) (Q_s/Q_d)]\} t \\ (10)$$

where t stands for the average tariff rate.

The second set of externalities arises in the exportable goods market. Export subsidies increase the resource costs to produce additional exportable goods while export taxes cause the national benefits from exporting to be greater than the domestic resource costs. The net externality in the exportable goods market is calculated as the ratio of the amount of subsidies (in excess of export taxes) associated with the cost of resources used to produce additional exports.*(6) Therefore, the net externality (r_2) associated with exportable goods can be expressed as follows*(7)

$$r_2 = - [(\frac{Q_{d,e}}{B}) dB + (h_e Q_{d,e} - e_e Q_{s,e}) (dE/E)] (m/dB) \\ = - \{(\frac{Q_{d,e}}{B}) + a[h_e q_{d,e} - (e_e q_{s,e}) (Q_s/Q_d)]\} m \\ (11)$$

where m stands for the average rate of subsidies over and above export taxes. Third, the VAT externality only applies to consumption items as business inputs are taxed first but can be claimed as credit under the consumption-type VAT. Only a fraction of the changes in the demand for tradable and non-tradable goods is represented by consumption goods. This fraction may differ greatly between the capital market operation on the one hand and the substitution effects that arise as a result of the change in relative prices on the other. Suppose the corresponding consumption fractions are denoted by b_1 and b_2 . In addition, the effective VAT rates generally are different for the tradable and non-tradable goods. These effective tax rates are denoted as n_t and n_{nt} ,

respectively. Given these assumptions, the VAT externality (r_3) can be computed by:

$$r_3 = \{b_1[(\frac{Q_{d,i}}{B}) + (\frac{Q_{d,e}}{B})] dB + b_2 (h_i Q_{d,i} + h_e Q_{d,e}) (dE/E)\} (n_t/dB) + [b_1 (\frac{Q_{d,nt}}{B}) dB + b_2 (h_{nt} Q_{d,nt}) (dE/E)] (n_{nt}/dB) \\ = [b_1 (\frac{Q_{d,i}}{B} + \frac{Q_{d,e}}{B}) + b_2 a(h_i q_{d,i} + h_e q_{d,e})] n_t \\ + [b_1 (\frac{Q_{d,nt}}{B}) + b_2 a (h_{nt} q_{d,nt})] n_{nt} \\ (12)$$

Fourth, in addition to the VAT, indirect taxes that do not give a credit for purchase of business inputs are also levied on certain specific commodities that are mainly consumption goods. For completeness and simplicity but within the same framework, we also measure the externalities caused by these taxes. We will calculate these effective indirect tax rates for tradable and non-tradable goods based on the aggregate demand in the economy rather than for excise goods alone due to the lack of detailed data. Let d_t and d_{nt} denote the average effective excise tax rates for the

tradable and non-tradable goods. The excise tax externality (r_4) can then be measured by:

$$r_4 = [(\frac{Q_{d,i}}{B} + \frac{Q_{d,e}}{B}) + a(h_{iQ_{d,i}} + h_{eQ_{d,e}})] d_t + [(\frac{Q_{d,nt}}{B}) + a(h_{ntQ_{d,nt}})] d_{nt} \quad (13)$$

While calculating the total foreign exchange externality of importable or exportable goods, one has to sum the above four components, r_1 , r_2 , r_3 and r_4 if funds are raised in the domestic capital market.

In the case where funds are raised in the domestic capital market and spent on non-tradable goods, j should replace a in equations (10) to (13) in order to calculate the respective foreign exchange externalities. Similarly, where foreign funds are used to purchase inputs, w should replace a in order to estimate the proper foreign exchange externalities.

Once the foreign exchange externalities are calculated for each individual case, we can combine all cases and determine in a consistent manner the total externalities in the economy based on alternative sources - domestic versus foreign - of the funds used to spend on either tradable or non-tradable goods for the project.

3 Empirical Estimation

In this section, we first estimate the various coefficients and parameters to be used in the model.

Then we simulate the model to estimate the foreign exchange externality for South Africa.

(a) Tradable versus Non-Tradable Goods

The products in an economy can be classified as importable, exportable, and non-tradable goods. In this paper, a good is considered importable if over 5 per cent of its demand for household expenditures, intermediate inputs and capital goods used in South Africa were met by imports. Likewise, if over 5 per cent of the quantity of a good produced in South Africa were exported, this good is included in the exportable goods category. Non-tradable goods had no more than 5 per cent of their consumption imported nor more than 5 per cent of their production exported.

Using the above criteria, the estimates are based on each of the 95 commodity categories obtained from the latest available input-output Tables, *Final Supply and Use Tables, 1998* published by Statistics South Africa. Of the total final demand in the South African economy in 1998, the amount of importable, exportable and non-tradable goods were estimated to be about 195,045 million Rand, 190,339 million Rand, and 242,292 million Rand. As well, of the total domestic production, the amount of importable, exportable, and non-tradable goods was 122,274 million Rand, 265,630 million Rand, and 242,575 million Rand, respectively.*⁽⁸⁾ Due to the lack of more up-to-date data, the 1998

economic structure in terms of tradable and non-tradable goods will be used for our purposes. The shares of these products and the ratio of the total supply to the total demand are shown below:

$q_{d,i} = 30.2 \%$; $q_{d,e} = 31.2 \%$;
and $q_{d,nt} = 38.6 \%$; $q_{s,i} = 19.3 \%$; $q_{s,e} = 42.1 \%$; and $q_{s,nt} = 38.6 \%$; and $Q_s/Q_d = 1.004$.

(b) Alternative Sources of Public Funds

When funds are obtained by borrowing in the capital market to finance a specific project, real interest rates tend to rise. In general, there are three ultimate sources of these funds: some would have been invested in other domestic activities, some would have been spent on private consumption, and some are sourced abroad via foreign capital inflows. The extent to which each source contributes to the funds depends upon its sensitivity to real interest rate. The proportions of these funds sourced are estimated for South Africa to be 62.5 per cent, 11.5 per cent, and 26.0 per cent, respectively.*⁽⁹⁾

For our purpose, it is important to identify what proportions of importable, exportable, and non-tradable goods are displaced when funds are extracted locally. By using the criteria established in^{com} Section 3a, we have identified each of the final demand commodities as importable, exportable and non-tradable goods. For each commodity, we take the weighted average of household expenditures and business demand for capital goods*⁽¹⁰⁾ and then group them by importable, exportable and non-tradable goods. The results for 1998 are 51,086 million Rand, 30,766 million Rand and 48,340 million Rand and, if expressed in percentages, they are:

$\frac{Q_{d,i}}{Q_B} = -39\%$, $\frac{Q_{d,e}}{Q_B} = -24\%$, and $\frac{Q_{d,nt}}{Q_B} = -37 \%$.

This means that the funds borrowed in the capital markets displaces other demands for capital and consumption expenditure that would otherwise have been made on these three categories of goods.*⁽¹¹⁾

(c) Demand and Supply Elasticities

With the substitution effects, equations (2a) and (3a) must hold true in terms of relative compensated elasticities of demand or supply of tradable and non-tradable goods. At present, very little empirical research has been carried out for South Africa on the estimation of these parameters. However, as these are large composite goods, we would expect that their compensated own-price elasticities of demand would be significantly less than one. Hence, we set the compensated

elasticities of demand for importable and exportable goods at $h_i = -0.5$ and $h_e = -0.4$, respectively. Equation (2a) gives us the result that the compensated elasticity of demand for non-tradable goods with respect to the foreign exchange rate (h_{nt}) would be approximately $+0.71$. This implies that, for one percentage increase in foreign exchange rate, the demand for non-tradable goods would increase by 0.71 per cent.

Similarly, if we assume that the supply elasticities of importable and exportable goods are: $e_i = 0.7$ and $e_e = 0.6$, equation (3a) implies that the elasticity of supply of non-traded goods with respect to the exchange rate (e_{nt}) would be about -1.00 .

(d) Assessment of Tariffs, Taxes and Subsidies

South Africa used to be a country with trade policies that were inward-oriented and promoted activities that were import-substituting. This included high and variable rates of tariffs, import surcharges for a number of commodities, and other non-tariff barriers. In addition, there were import permit requirements imposed on a number of goods, ranging from foodstuffs, chemicals, textiles, and machinery.*(12) Such substantial protection mechanisms imposed an anti-export bias, even though duty drawback schemes were also in place to help exports. In the early 1990s, along with global trade liberalization, South Africa started to open up its economy and rationalized its trade policy by lowering the overall import tariff rates, removing import surcharges, and reducing quantitative restrictions.*(13)

In order to calculate import tariff rates, one has to exclude re-exported imports. There is no reliable data available in South Africa, but the amount is likely to be small relative to other countries. We assume that 2.5 per cent of exports are re-exports of imported goods in South Africa. Table 1 shows that average effective tariff rates including import surcharges have declined over the past seven years from 5.82 per cent to 3.61 per cent.

Table 1. Import Trade Statistics, 1994-2000. (Millions of Rands)

Year	Gross of Re- exported Imports	Re-export	Net of Re- exported Imports	Tariffs	Import Surcharg es	Average Tariff & Subsidy Rate
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Republic of South Africa, National Treasury, *Budget Review, 2001*, (February 21, 2001).

Since the political reform in 1994, South Africa has begun to diversify its trading relationships with the rest of the world. It joined the Southern African Development Community (SADC) in 1994 and gradually liberated trade, expecting a complete regional free trade area to emerge by 2012. At the same time, the U.S. granted South Africa a generalized system of preferential status, providing easier access to the U.S. markets for some commodities. In early 1999, South Africa also signed a free trade agreement with the European Union (EU) that is expected to be phased in over the next 10 to 12 years.*⁽¹⁴⁾

Despite various trade agreements, the pace of implementation of tariff reductions, especially under the SADC Agreement, appears to be slow, in tandem with the pace of the reduction of non-tariff barriers.*⁽¹⁵⁾ For the purpose of this exercise, we assume the overall effective import tariff rate (t) at 3.6 per cent.

In South Africa, there are direct subsidies payable per unit exported to encourage exports in addition to product-linked subsidies on products used domestically. They are shown in Table 2 for the past seven years. These figures represent aggregate subsidies and are not separated for exported and domestically consumed goods. We assume the subsidy rate for exports is the same as goods for domestic consumption. The rate of subsidy has declined from 1.45 per cent in 1994 to 0.61 per cent in 2000. For this exercise, we assume the subsidy rate for exports (m) is 0.60 per cent. There are no export taxes now in South Africa.

In 1991 South Africa replaced the General Sales Tax - a retail sales tax - by a consumption-type VAT with a rate of 12 per cent. The current rate is 14 per cent. The tax is applied to sales and services at all stages of each production and distribution chain. It follows an invoice-credit method, with full credits allowed for the purchase of intermediate inputs and capital goods. However, there are a number of goods and services that are either zero-rated or tax exempt in South Africa. For example, basic food such as bread, rice, vegetables, fruits, milk, eggs and farming inputs are zero-rated. The system also exempts financial services, education, road and rail transportation services. For the exempt services, taxes paid on inputs are not creditable and thus passed forward to the final consumers in higher prices or embodied in the prices of goods or services. For this study, we estimate that the above hidden taxes would be about 5 per cent for transportation services and 2 per cent for financial, education and other services because of lower value added for the former and higher for the latter.

Table 2. Export Subsidies, 1994-2000.(Millions of Rands)

Year	Subsidies On Products	Gross Value added at Basic Prices	Average Subsidy Rates
1994	6,400	440,147	1.45%
1995	5,898	500,354	1.18%
1996	5,746	565,978	1.02%
1997	5,387	625,418	0.86%
1998	5,953	670,383	0.89%
1999	4,672	723,247	0.65%
2000	4,809	793,993	0.61%

Sources: South African Reserve Bank, *Quarterly Bulletin*, March 2001.

As per our definition of tradable and non-tradable goods assumed in section 3a, we can calculate the average effective VAT rates for tradable and non-tradable goods based on the 1998 household consumption patterns. They are:

$n_t = 11.36\%$ and $n_{nt} = 6.54\%$.

Recall we are dealing with two operations in this general equilibrium setting, funds extraction from the capital market as well as the substitution effects on the quantities demanded and supplied due to changes in the relative prices of tradable to non-tradable goods. The proportion of changes in demand for tradable and non-tradable goods that are attributable to consumption goods may be quite different between these two operations. In the case of capital extraction, the proportion of consumption that is extinguished is estimated from alternative sources of government borrowing and its spending on tradable and non-tradable goods domestically. That is, $b_1 = 0.156$.(16)

In the case of changes in demand due to substitution effects, one can calculate b_2 as the proportion of household and government consumption in total final demand including household consumption, government consumption and business demand for capital goods. Based on the 1998 input-output tables, $b_2 = 0.804$.

In South Africa, there is a set of excise duties levied on specific commodities at a single stage with specific rates. These products include mineral water, alcoholic beverages, cigarettes and tobacco products, motor vehicles, and petroleum products. There are also numerous commodities that are subject to ad valorem excise duties. They include cosmetics, fur clothing, air conditioners, computers and printing machines, discs and magnetic tapes, radios, dishwashers, etc. Due to the lack of a detailed breakdown of commodities that are subject to excise duty, we calculate the effective excise duty rates for all tradable and non-tradable goods including excise and non-excise commodities. With the same definition of tradable and non-tradable goods assumed in section 3.a, all excisable goods are considered tradable goods. The effective excise duty rates were estimated at: $d_t = 5.63\%$ for tradable

goods and $d_{nt} = 0$ % for non-tradable goods.*(17)

(e) Evaluation of the Foreign Exchange Externalities

Following the model outlined in section 2, we will first calculate the foreign exchange externality for each of three individual cases. The results are based on the 1998 economic structure and the current tax and subsidy distortions. We then combine them to determine the total externalities for the entire economy in South Africa.

(i) Domestic Funds Used to Purchase Business Inputs

In the case where the public funds are extracted solely from the local market and spent on importable goods, we should first estimate the coefficient a from equation (5). That is, $a = +0.5563$.

Using coefficients and parameters estimated from sections 3a to 3d, we simulate the model to generate a set of equilibrium values including changes of demand and supply of importable, exportable, and non-tradable goods. For example, the first panel of Table 3 presents the results when 100 Rand is drawn locally and spent on importable goods.

Table 3. Impact of Capital Extraction and Spending on Project Inputs under Various Cases (Rands)

Capital Sourcing and Spending on Business Inputs	Importables	Exportables	Non-Tradables
A. Funds Borrowed Domestically			
(1) Project Demand for Importables	+100.0		
Displacement of Domestic Demand due to Capital Extraction	-39.0	-24.0	-37.0
Effect of Real Exchange Rate on Demand	-8.4	-6.9	+15.3
Effect of Real Exchange Rate on Supply	+7.6	+14.1	-21.7
Excess Demand for Goods	+45.0	-45.0	0
(2) Project Demand for Exportables		+100.0	
Displacement of Domestic Demand due to Capital Extraction	-39.0	-24.0	-37.0
Effect of Real Exchange Rate on Demand	-8.4	-6.9	+15.3
Effect of Real Exchange Rate on Supply	+7.6	+14.1	-21.7
Excess Demand for Goods	-55.0	+55.0	0
(3) Project Demand for Non-Tradables			+100.0

Displacement of Domestic Demand due to Capital Extraction	-39.0	-24.0	- - 37.0
Effect of Real Exchange Rate on Demand	+14.3	+11.8	- -26.1
Effect of Real Exchange Rate on Supply	-12.9	-24.0	- +36.9

Excess Demand for Goods	-11.8	+11.8	- 0
B. Funds Borrowed from Abroad			
(1) Project Demand for Non-Tradables			
Displacement of Domestic Demand due to Capital Extraction			
Effect of Real Exchange Rate on Demand	+22.7	+18.8	-41.5
Effect of Real Exchange Rate on Supply	-20.4	-38.1	+58.5
Excess Demand for Goods	+43.1	+56.9	0

A devaluation of the real exchange rate will lower demand by 8.4 Rand for importables, 6.9 Rand for exportables but increase the demand for non-tradables by 15.3 Rand. In the meantime, the supply of importables and exportables will increase by 7.6 Rand and 14.1 Rand, respectively, balanced by a reduction of non-tradable supply by 21.7 Rand. In the end, the sum of the excess demand for importables and exportables is equal to zero. The market in non-tradable goods is also in equilibrium. With these results along with equations (10), (11), (12) and (13), we can calculate r_1 , r_2 , r_3 and r_4 , respectively. They are: $r_1 = -1.98\%$, $r_2 = +0.27\%$, $r_3 = -2.09\%$, and $r_4 = -4.41\%$. Thus, the total externality associated with the extraction of funds solely from the local market and spent on importable goods would be -8.21% .

The second panel of Table 3 shows the economic effects of extracted funds solely via the local capital market and spent on exportable goods. The results are shown to be exactly the same as that spent on importable goods. Thus, the total externality of local funds spent on exportable goods would also be -8.21% .

In the case of funds extracted from the local market and spent on non-tradable goods (see the third panel of Table 3), we first estimate j from equation (7), i.e. $j = -0.9473$. Following (10), (11), (12), and (13), and with the replacement of a by j , one can estimate: $r_1 = -0.43\%$, $r_2 = -0.07\%$, $r_3 = -0.48\%$, and $r_4 = -2.08\%$. Thus, the total of these externalities would be -3.06% .

(ii) Foreign Funds Used to Purchase Business Inputs

In the case where public funds are obtained from the foreign market and spent on importable or exportable goods, no externality should occur because there is no excess supply or demand for foreign exchange in the economy. However, if foreign funds are used to purchase non-tradable goods, there is

a significant impact on the economy as shown in the last panel of Table 3. We first estimate the coefficient w from equation (9). That is, $w = -1.5036$. Using equations (10), (11), (12), and (13), and replacing a with w , one can estimate: $r_1 = +1.55\%$, $r_2 = -0.34\%$, $r_3 = +1.61\%$, and $r_4 = +2.33\%$. Thus, the total externalities are $+5.15\%$. This means that instead of a cost, a benefit of 5.15% would reduce the economic cost of any externalities for – non-tradable goods.

(iii) Summary of Externalities

The values of the externalities of public funds spent on tradable and non-tradable goods depend very much upon the weights given to the various sources of funds. The externalities are summarized in Table 4. When funds are sourced locally, the externality would be about -8.21% for tradable goods and -3.06% for non-tradable goods. If funds are sourced abroad and spent on non-tradable

goods, the externality would be $+5.15\%$.

*Table 4. Summary of Externalities
(percentage)*

Funds Drawn From	Funds Spent on Tradable Goods	Funds Spent On Non-Traded Goods
Domestic Capital Source	-8.21	-3.06
Foreign Capital Source	0	+5.15
Capital Market Weights (Domestic:74%, Foreign:26%)	-6.08	-0.93

In South Africa, when a project draws public funds to finance its expenditures on business inputs about 74 per cent of the capital would come from the domestic market and 26 per cent from abroad. Therefore in the determination of their economic values a foreign exchange premium of 6.08 per cent should be added to the expenditures on tradable business inputs and 0.93 per cent added to the expenditure from non-tradable inputs. The reason for having an impact on non-tradable goods is interesting in a general equilibrium framework. The creation of the externalities occurs indirectly through the adjustment of the quantities of demand and supply due to the adjustment of the exchange rate. The positive and negative externalities somewhat offset each other due to the sourcing of funds from the domestic and foreign capital markets. Similarly, when a project generates output, a benefit of 6.08 per cent should be added to tradable outputs and 0.93 per cent to non-traded outputs.

4 Sensitivity Analysis

The above empirical results depend on the demand and supply elasticities of importable and exportable goods as well as the criteria for determining the shares of tradable and non-tradable goods assumed. A sensitivity analysis is performed to determine the robustness of the estimates.

(i) Demand and Supply Elasticities of Tradable Goods

In this sensitivity analysis, we assume higher demand and lower supply elasticities for importable and exportable goods as compared to the case presented earlier. That is, -0.7 and -0.6 instead of -0.5 and -0.4 for the corresponding demand elasticities for importable and exportable goods, respectively. For the supply elasticities, we assume a lower response for the importable and exportable goods at $+0.5$ and $+0.4$ instead of $+0.7$ and $+0.6$.

For consistency, if $h_i = -0.7$ and $h_e = -0.6$, equation (2a) requires that the elasticity of demand for non-tradable goods with respect to the real exchange rate (h_{nt}) would be $+1.03$. Similarly, if $e_i = 0.5$ and $e_e = 0.4$, equation (3a) ensures that the elasticity of supply of non-tradable goods (e_{nt}) with respect to the real exchange rate would be -0.69 .

With the changes of demand and supply elasticities of non-traded goods, the coefficients a , j and w become $+0.5568$, -0.9479 , and

-1.5047 if the funds were extracted solely from the local market and spent on importable goods and non-tradable goods, and if the funds were sourced abroad and spent on non-tradable goods.*(18)

Following the same approach as outlined in section -2, we can calculate each total externality from extracting public funds from the local/foreign capital markets and spending these funds on tradable or non-tradable goods. The results are presented in Table 5a.

Table 5a. Components of the Externalities in the Sensitivity of demand and Supply Elasticities (percentage)

	r₁	r₂	r₃	r₄	Total
a = +0.5568	-2.02	+0.26	-2.35	-4.80	-8.91
j = -0.9479	-0.35	-0.06	-0.03	-1.42	-1.86
w = -1.5047	+1.67	-0.32	+2.32	+3.38	+7.05

The results of the externalities with consideration of the proportion of sourcing of funds are shown in Table 5b. In this situation, the foreign exchange premium would be 6.59 per cent more than the market expenditures on tradable business inputs, but for non-tradable inputs the economic cost would be 0.46 per cent lower than their financial cost. As compared to the results for the base case the result is 0.51 of one percentage point higher cost for tradable goods and 1.39 of one percentage point lower cost for non-tradable goods.

Table 5b. Summary of Externalities for Sensitivity in Elasticities (percentage)

Funds Drawn From	Funds Spent on Tradable Goods	Funds Spent on Non-Traded Goods
Domestic Capital Source	-8.91	-1.86
Foreign Capital Source	0	+7.05
Capital Market Weights (Domestic:74%, Foreign:26%)	-6.59	+0.46

(ii) Shares of Tradable and Non-Tradable goods

If the criterion for defining tradable and non-tradable goods is increased from the earlier 5 per cent (of demand and supply) to 7.5 per cent, the proportion of importables and exportables in the economy would be reduced and the non-traded goods would be increased as follows:

$q_{d,i} = 29.0\%$; $q_{d,e} = 22.9\%$; and $q_{d,nt} = 48.1\%$; $q_{s,i} = 17.4\%$; $q_{s,e} = 34.5\%$; and $q_{s,nt} = 48.1\%$; and $Q_s/Q_d = 1.004$.

Similarly, the impact of the sourcing of the funds on the demand for tradable and non-traded goods would be altered and are shown below:

$\%Q_{d,i}/\%B = -38\%$; $\%Q_{d,e}/\%B = -20\%$; and $\%Q_{d,nt}/\%B = -42\%$.

As a result of changes in the shares of importable, exportable, and non-traded goods, the elasticities of demand and supply of non-traded goods would become +0.49 and –0.68, respectively. The average effective VAT and excise duty rates would also be changed to: $n_t = 10.88\%$; $n_{nt} = 8.19\%$; $d_t = 4.54\%$; and $d_{nt} = 2.28\%$.

With the above changes, we have simulated the model and the results of externalities are summarized in Table 6. The foreign exchange premium would add 5.71 per cent to the economic cost of expenditures on tradable business inputs and increase the economic cost by 2.39 per cent for expenditures on non-traded inputs. The result is 0.37 of one percentage point lower cost on tradable goods but 1.46 of one percentage point higher cost on non-traded goods than was the situation with the base case.

From the above experiments we find that the premium on foreign exchange ranges from 5.71 per cent to 6.59 per cent of its market value on tradable goods and from –0.46 per cent to 2.39 per cent on non-tradable goods. Although more cases could be simulated, we believe the mean values for the ranges would give us a reasonable value for the foreign exchange premium on tradable goods of 6.2 per cent and a premium on non-tradable goods of 1.4 per cent.

Table 6. Summary of Externalities for Sensitivity in Shares of Tradable and Non-Tradable Goods (percentage)

Funds Drawn From	Funds Spent on Tradable Goods	Funds Spent on Non-Traded Goods
Domestic Capital Source	-7.72	-4.36
Foreign Capital Source	0	+3.23
Capital Market Weights (Domestic:74%, Foreign:26%)	-5.71	-2.39

5 Concluding Remarks

This paper provides an analytical framework and a practical approach to the measurement of the economic cost of foreign exchange for South Africa. The analysis takes into account the capital extraction required to finance the purchase of business inputs and the substitution effects due to the changes in relative prices of tradable to non-tradable goods in a general equilibrium setting.

The empirical results suggest that the additional cost of the use of, or the benefit from generating, foreign exchange in South Africa would be approximately 6.2 per cent of the market value of tradable goods. At the same time there is a small per cent premium on the expenditures or receipts of non-tradable goods of 1.4 per cent. These figures represent the value of the generalized distortions that are created by differences between the market and the economic value of expenditures on traded and non-traded goods, respectively, when the funds used to make these expenditures are sourced from the capital market. In practical applications to cost-benefit analysis for new investments, a conservative adjustment to the values of traded and non-traded resource flows, of 6.0 and 1.0 per cent, respectively, is recommended.

Appendix a Impact of Capital Extraction and Spending on Project Inputs under Alternative Elasticities (Rands)

Capital Sourcing and Spending on Business Inputs	Importables	Exportables	Non-Tradables
A. Funds Borrowed Domestically			
(1) Project Demand for Importables	+100.0		
Displacement of Domestic Demand due to Capital Extraction	-39.0	-24.0	-37.0
Effect of Real Exchange Rate on Demand	-11.8	-10.4	+22.2
Effect of Real Exchange Rate on Supply	+5.4	+9.4	-14.8
Excess Demand for Goods	+43.8	-43.8	0
(2) Project Demand for Exportables		+100.0	
Displacement of Domestic Demand due to Capital Extraction	-39.0	-24.0	-37.0
Effect of Real Exchange Rate on Demand	-11.8	-10.4	+22.2
Effect of Real Exchange Rate on Supply	+5.4	+9.4	-14.8
Excess Demand for Goods	-56.2	+56.2	0
(3) Project Demand for Non-Tradables			+100.0
Displacement of Domestic Demand due to Capital Extraction	-39.0	-24.0	-37.0
Effect of Real Exchange Rate on Demand	+20.0	+17.8	-37.8
Effect of Real Exchange Rate on Supply	-9.2	-16.0	+25.2
Excess Demand for Goods	-9.8	+9.8	0
B. Funds Borrowed from Abroad			
(1) Project Demand for Non-Tradables			+100.0
Displacement of Domestic Demand due to Capital Extraction	-	-	-
Effect of Real Exchange Rate on Demand	+31.8	+28.2	-60.0
Effect of Real Exchange Rate on Supply	-14.6	-25.4	+40.0
Excess Demand for Goods	+46.4	+53.6	0

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Endnotes

1 (Popup - Popup)

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2 (Popup - Popup)

Discussions of the concept can be found in Belli, Anderson, Barnum, Dixon and Tan (2001); Harberger and Jenkins (2002).

3 (Popup - Popup)

Various tax and subsidy distortions were incorporated in this model. The foreign exchange premium was estimated in simulations where the purchase of tradable goods used in the project was either financed by income taxes or foreign capital inflows. See Jenkins and Kuo (1985).

4 (Popup - Popup)

Harberger and Jenkins

(2002). 5 (Popup -

Popup) as the quantitative controls are assumed to not change as a result of the

The non-tariff barriers are excluded analysis from this financing and expenditures of the project.

6 (Popup - Popup)

It may be noted that the sum of the change in net exportables and the change in net importables should be equal to zero when a new equilibrium is re-established.

7 (Popup - Popup)

An increase of exportables implies an additional subsidy and thus shows a negative externality for consistency with other measures.

8 (Popup - Popup)

The classification of the goods and services of the economy into importable, exportable and non-traded might contain some misclassification due to the aggregation sectors. The initial data show that the shares in aggregate demand are 31.1 per cent, 30.3 per cent, and 38.6 per cent for importable, exportable and non-tradable goods, respectively. The corresponding shares in the supply side are 19.4 per cent, 42.1 per cent, and 38.5 per cent. The close correspondence of the aggregate sizes of the demand and supply of non-traded goods in our classification (about 0.1 per cent differential) indicates that our classification between tradable and non-tradable is fairly accurate. They are, nevertheless, calibrated to the figures presented in the text.

9 (Popup - Popup)

This is the central case of various scenarios. See Kuo, Jenkins, and Mphahlele (2002). Details of the conceptual framework can be found in Harberger (1972), Harberger and Jenkins (2002).

10 (Popup - Popup)

The weights are 11.5 per cent for household consumption and 62.5 per cent for business investment. See Kuo, Jenkins, and Mphahlele (2002).

11 (Popup - Popup)

These shares represent the marginal displacement of expenditure as a result of the extraction of funds from the capital market. As we estimate these values we use the proportions of importable, exportable and non-tradable goods and services demanded in the economy after deducting the amounts of government expenditures made on each of these three categories of goods and services.

12 (Popup - Popup)

See Belli, Finger and Ballivian (1993).

13 (Popup - Popup)

Tsikata (1999).

14 (Popup - Popup)

South Africa will get access to EU markets over ten years while the reverse will take twelve years. See, *e.g.*, Lewis (2000).

15 (Popup - Popup)

Flatters (2001).

16 (Popup - Popup)

This can also be obtained from dividing 11.56 per cent (the forgone consumption) by the sum of 11.56 per cent plus 62.43 per cent (forgone consumption and displaced investment). See Kuo, Jenkins, and Mphahlele (2002), Table 1.

17 (Popup - Popup)

Excise duties by detailed commodity category were obtained from Republic of South Africa, National Treasury (2001). For calendar year 1998, excise duties were 21,685 million Rand for tradable goods.

18 (Popup - Popup)

For a case of drawing 100 Rands in the market and used to purchase tradable and non-tradable goods, the impact on the demand and supply of importable, exportable and non-tradable goods can be found in Appendix A.