

# **A thinly-based economy: The Discussion of the Diamonds and Beef industries on the Botswana economy**

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## **Abstract**

After more than three decades of phenomenal growth, Botswana still manifests a dualistic economy in which a significant percentage of the population live in non-formal, agricultural sector. One major policy issue of concern to the Government of Botswana is that of poverty alleviation and income distribution through improvements in the rural economy. Thus any trade shock that impact on the agricultural sector, is likely to have adverse welfare effects on majority of the population. It is for that reason that this section would simulate a scenario, that captures the combined welfare effects of the International diamond market shocks (described above) and the export food-processing price shocks. To simulate the case of poverty and income distribution in Botswana, we run experiments, which explore the effects of an external shock resulting from a change in the international price of meat products, and minerals.

The most interesting results for the simulation is the income distribution effects of the shock. Given the fact that the food processing sector, which is labour intensive in Botswana, has strong linkages with a number of sectors, most of which are labour intensive too a fall in the international price of beef is likely to result in a rise in unemployment in the country as shown through the factor demand results. On the other hand the mining sector contributes the largest of national output and is the largest contributor to government revenues. The government of Botswana is the largest employer, saver and investor and the second largest economic sector.

In general the results give credence to the argument that diversification of the economy in Botswana has not been a success so far; and that much of what has been achieved so far, is still very much tied to the performance of the primary export commodities, minerals and beef.

## **1.1: Introduction**

After more than three decades of phenomenal growth, Botswana still manifests a dualistic economy in which a significant percentage of the population live in non-formal, agricultural sector. Major policy issues of concern to the Government of Botswana are (1) poverty alleviation and (2) income distribution through improvements in the rural economy. Thus any trade shock that impact on the agricultural sector, is likely to have adverse welfare effects on majority of the population. It is for that reason that this section would simulate a scenario, that captures the combined welfare effects of the international diamond market shocks (described above) and the export food-processing price shocks. To simulate the case of poverty and income distribution in Botswana, we run experiments, which explore the effects of an external shock resulting from a change in the international price of meat products, and minerals.

There is wide agreement in the development literature that sustained economic growth in heavily agricultural countries is not likely to be achieved without a prior, or simultaneous, development of agriculture. In Botswana, while agriculture accounts for one of the smallest shares in sectoral GDP, it nevertheless remains a significant source of income for many households in rural areas through its linkage with other sectors of the economy particularly the food-processing sector. A large proportion of the Botswana population live in rural areas. In the early 1980s, rural households` own agricultural produce accounted for 23 percent of rural incomes. In addition to this, cattle farming in rural areas along with other activities, helped to provide cash income.

Indeed, the positive association between agricultural growth and overall economic growth among developing countries is a firmly established empirical generalisation. That agricultural development is a significant determinant of growth in other sectors of the economy has been argued persuasively for a number of countries in historical terms and in counterfactual simulations (Timmer; 1988).

## **2.1: The Structure of the Botswana Economy**

Botswana was one of the poorest countries when she attained political independence in 1966 with a per capita income of about US\$400 in 2000 prices. The poverty situation was accentuated by several years of drought, which coincided with the achievement of independence. One third of the national cattle herd died, while one fifth of the population received famine relief from the international community.

At independence in 1966, Botswana, typical of a poor developing country, relied heavily on agriculture. Beef products were the most important export commodities. Apart from the railway line,

communication and infrastructure were poorly developed, and prospects for rapid development of the economy were bleak.

Gross Domestic Product (GDP) in current prices was estimated at US\$ 7.4 million in the 1966/67 fiscal years. However, self-sufficiency in the recurrent budget was achieved by 1974/75 financial years as a result of the discovery of diamonds. The diamond industry transformed Botswana from an agricultural-based economy to one in which diamonds account for 80 percent of exports and 50 percent of Government revenues. The remaining part of exports came from beef, copper nickel and manufactured products, though the manufacturing sector's contribution was not that significant in terms of foreign earnings until fairly recently.

Mineral revenues have enabled the government to build up large foreign exchange reserves, which amounted to around \$5.5 billion in 2002. Botswana continues to borrow only small amounts of money abroad; total external debt as a percentage of exports of goods and services was only 4.4 per cent in 2000, compared to 19.3 per cent for Sub-Saharan Africa (World Bank, 1996).

Thus the economy of Botswana is highly dependent on minerals this dependency being indicated by the strong linkages between the minerals sector and the other sectors of the economy, through the 'fiscal' linkages. Therefore in order to capture the impact of international trade liberalisation on different sectors of the economy, it is important to isolate the influence of the mineral sector from the rest of the economy. This is done through the closure conditions described in section 4.1.

### **2.1.1: The Beef Industry**

Botswana's success story, as indicated above, also raises serious questions about internal economic integration. After more than three decades of phenomenal growth, Botswana still manifests a dualistic economy in which a significant percentage of the population live in non-formal, agricultural sector. One major policy issue of concern to the Government of Botswana is that of poverty alleviation and income distribution through improvements in the rural economy. Thus any trade shock that impact on the agricultural sector, is likely to have adverse welfare effects on majority of the population.

In January 31, 1975, in Brussels, the European Economic Community (EEC) entered into an agreement with 46 countries in Africa, the Caribbean, and the Pacific, commonly known as ACP countries. The signature ceremony took place on February 28, 1975, at Lome', the capital of Togo, which is why the convention is referred to as the Lome' Convention. The main features of the convention were as follows:

- free access without reciprocity to the European market for goods exported from the ACP;

- stabilization fund to compensate the ACP in the event of reduced receipts from the export of some of their principal commodities;
- financial aid for the ACP;
- industrial and technological cooperation, aimed at a better international division of labour on lines advantageous to the ACP.

The Convention specified that goods originating in ACP countries shall be accessible to the EU market free of customs duty and taxes of equivalent effect, and without being subject to quotas or other quantitative restrictions. This is undertaken through what is called the Generalized System of Preferences (GSP); however, since the GSP is related to the Most Favoured Nation rate (MFN), which in many cases is reduced each year in line with the EU's Uruguay Round obligations, the GSP is likely to be phased off by 2005.

ACP access to the EU market is also affected by the EU's rules of origin. These rules are intended to enable the customs administration in the EU to identify products it can regard as having originated in the ACP countries and thus as eligible for free access.

Botswana benefits from the Generalised System of Preferences (GSP), which applies to trade with industrialised countries, and under which the tariff reduction facility applies to limited quantities of specified export products. In recent years this facility has proved useful in setting up an incentive package for an experimental export-processing zone under the Selebi-Phikwe Regional Development Plan (SPRDP). The facility is used to induce South Africa whose EU quotas have been filled, to take up textile production locally for export, under Botswana's quota.

Botswana exports of food processing (beef) have, since 1975, been eligible for preferential treatment enabling tariff-free access to the European market, under a quota system. Exports to the EU are sold above world prices, and this translates into higher sales revenues for Botswana beef exports than would be attained in world markets. Botswana has never been able to meet its full beef export quota (18,916 tonnes per annum until year 2000) to the EU.

Under the latest ACP-EU Partnership Agreement, signed on 23 June 2000, the existing trade provisions will continue until 2008; a change in this agreement after 2008 will affect Botswana's beef industry and our model will capture this. The most important part for Botswana of the ACP-EU Agreement is Protocol 4 on Beef and Veal. Under this protocol the EU and the ACP states, which are traditional exporters of beef and veal, agreed on the following:

Customs duties other than ad valorem duties applicable to beef and veal originating in the ACP States shall be reduced by 9%. This reduction in customs duties shall apply to the following quantities expressed in boneless meat per calendar year and per country:

The agreement specifies arrangements for negotiating how to replace the non-reciprocal preferential (Lome) regime with WTO-compatible (reciprocal) Economic Partnership Agreements (EPAs). As indicated above, the new agreement is a 20-year accord under which the current Lome trade preferences will be extended at least through 2008. This is given by table 3.3 below.

**Table 3.2: Beef Exports by Country**

Country	Tons of Beef
Botswana	18,916
Kenya	142
Madagascar	7,579
Swaziland	3,363
Zimbabwe	9,100
Namibia	13,000

Source: CSO, Botswana

**Table 3.3: Cotonou Agreement Timetable**

Table 3.3: COTONOU AGREEMENT TIMETABLE		
FEB 2000-SEP 2002	Preparation for negotiations	Lome trade terms maintained if granted waiver by the WTO
Sept. 2002-Dec. 31, 2007	EU-ACP negotiations	Lome trade terms maintained if granted waiver by the WTO If granted, waiver on Lome trade terms expires on Dec. 31, 2007
Jan. 1, 2008-2020	Implementation of EPAs	ACP signatories of EPAs to open their markets to EU imports leading to reciprocal free trade between the EU and ACP states LDCs who do not sign EPAs keep their Lome trade terms. Non-LDCs who do not sign EPAs get GSP
From 2020	Reciprocal EPAs	EU-ACP FTA for signatories of EPAs

Source: BIDPA

### **2.1.2: The Mineral Industry**

Botswana discovered and began mining diamonds in the late 1960s. Large-scale exploitation of these discoveries affected for the most part, real incomes, the relative sizes of economic sectors and intersectoral allocation of capital and labour.

The Central Selling Organisation (CSO) is the marketing arm of De Beers, responsible for the marketing of a high percentage of the world's diamonds. The CSO produces 46% of the world's diamonds by carat weight and intervenes heavily in the open market to account for approximately 71% of world production in 1996 (A. Robertson, 1997). This market intervention effectively controls the diamond price and prevents the usual supply/demand factors influencing the price of diamonds. These controls are mainly through quotas placed on members of the CSO such as Botswana. The average price per carat of diamonds is US\$69.00 but depending on quality can range from US\$10.00 (average for Australian diamonds) to US\$ 320.00 (average for Botswana diamonds).

However the Central Selling Organisation has recently been forced to face up to the problems of the so-called 'conflict-diamonds' and producers who sell independently in the international market. For instance, in recent years, as the result of civil strife, a considerable quantity of contraband diamonds from Angola, Sierra Leone and the Democratic Republic of Congo, have surreptitiously reached the market. Other producers, especially in Australia and Russia, have tried to avoid the cartel by marketing independently.

International competition and the slow down in global economic growth, has forced De Beers to conduct a review of its operations in response to falling growth in diamond sales, with the CSO being disbanded and replaced by the Diamond Trading Company, aimed at streamlining the rough diamond market system. This streamlining of the market is anticipated to entail reducing the degree of market intervention. If this does happen then the economic policy environment facing the government of Botswana will change enormously. Moreover this change will take place against a rapidly changing policy environment in southern Africa, e.g., the liberalisation of South African economic policy, with its attendant changes in SACU policies and the EU-SAFITA; discussions over economic integration within SADC; and the growing pressures of globalisation, in part associated with the WTO negotiations.

### **3.1 The Computable General Equilibrium Model for Botswana**

To explore the impact of a food processing export price fall of 30% (in foreign currency), on the economy of Botswana we developed a computable general equilibrium (CGE) model for Botswana. For this we used the 1993/94 social accounting matrix (SAM) as a database, calibrated the CGE to the base year values, and used it to run simulations of external shocks on the economy.

CGE modelling, a powerful methodological tool for policy analysis is widely used in various fields of economic research. A CGE model is an appropriate instrument to analyse external shocks and domestic policies in which multisectoral linkages are important. Thus they cast a light on distributional and allocate efficiency aspects of different sectors of the economy.

The model is Walrasian. This means that in CGE modeling, the study of the behavior of economic variables takes full account of the interaction between endogenous variables and their relationships with the exogenous variables (Robinson; 1989). To explain this interaction we start by discussing on the behavioral relationships in the model, which are captured by non-linear first optimality conditions for production and consumption decisions. In this model, domestic production uses a two-stage production process.

A survey by Bandara (1991) of CGE models which have been used to analyses development policies in less developed countries reports that, by the end of 1988, at least 70 CGE models had been applied to 30 LDCs. In an earlier survey Decaluwe and Martens (1987) reviewed 42 of what they refer to as General Equilibrium Models, which had been applied to 20 developing countries, with 30 of these studies having been undertaken within five years prior to the survey.

Bandara (1991) lists six broad issues that CGE models for less developed countries have been developed to address. These are (a) choice of development strategy, (b) income distribution, (c) structural adjustment to external shocks, (d) tax policy, (e) long-term growth and structural change and (f) trade policy. Of the 42 studies surveyed by Decaluwe and Martens (1987), 24 simulated the effects of external trade shocks.

The relevant theoretical developments for the CGE literature began in the late 1930s and consisted of both pure theoretical work on general equilibrium issues as well as empirical work on different model specifications and solution techniques. In 1941 Leontief developed the first empirical model of a national economy. His work, *The Structure of the American Economy 1919-1929*, represents the classic input-output study (Leontief, 1941). It was influenced by the recession of the 1930s and was applied to policy simulations during World War II. Stimulated by Hick's publication of *Value and Capital* in 1939 (Hicks, 1939), Samuelson, Arrow, Debreu, Hahn, McKenzie and Negishi pushed forward the development of general equilibrium theory. Thus the theoretical basis of CGE models is general equilibrium theory, and CGE models are therefore the empirical counterparts of the theoretical general equilibrium framework, which is conceptually capable of capturing all real interactions since it can incorporate all possible commodity and factor markets and decision-making agents.

CGE models are defined by Kelly (1994:33) as "...essentially complicated versions of the circular flow diagram taught introductory economies, where the system of equations maps the flow of goods,

services and factors as well as the monetary flows between sectors of the economy.” The first CGE model was developed by Johansen (1960).

Since this first CGE model by Johansen in 1960, there has been a proliferation of surveys of CGE models and their applications, especially in the past 20 years of such models. These surveys tend to suggest that multi sectoral analyses, which use a CGE model, are superior to partial equilibrium analysis. Owing to its appropriateness in evaluating policy changes and external shocks, alongside improved statistical data bases and the availability of solution software packages such as the General Algebraic Modeling System (GAMS), there has been increased application of CGE models to the analysis of policy issues of less developed countries.

CGE models define the economy in terms of economic agents specifically: households who are suppliers of factors and are consumers of goods and services; production sectors which are purchasers of factors and intermediate inputs and suppliers of goods and services; the government which is a collector and disburser of revenues and finally the external trade sector. They have been applied to a variety of problems, with varying dimensions, from models of a small open economy with two sectors, two factors and one household, to global models with many countries, factors and households. Their attraction is that they are based on microeconomic theory, and allow for linkages between markets and for substitution between factors and between goods in response to relative price changes (Horridge; 1994).

In its basic form, a CGE model is a neo-classical model assuming profit-maximizing firms, utility-maximizing consumers, continuous production and utility functions, no intermediate inputs, no joint products, and price-clearing competitive markets for all goods, services and factors. A model may be classified as structuralist “...if it significantly deviates from the assumptions” (Lofgren; 1994:6), e.g. by assuming fixed volume shares of factors. Or it may be classified as behavioural, such as most static CGE models that describe the economy in accordance with the structure of the Social Accounting Matrix. This is the type we will employ for our analysis of the international trade shocks on the economy of Botswana.

In this model production activities are carried out to maximize profits, subject to the technology employed for production. Production technology is defined by a Constant Elasticity of Substitution (CES) production function, which is given by equation (X1). The use of the CES functional form implies that there is imperfect substitutability between factors of production.

$$QX_a = ad_a * \left[ \prod_f \delta_{f,a}^\rho * FD_{f,a}^{-\rho} \right]^{-1/\rho} \quad (X1)$$



Given the CES production function, the activities output ( $QX_a$ ) is determined by the sum of factor demand ( $FD_f$ ), efficiency parameters ( $ad$ ), the share parameters ( $\delta$ ), and the CES elasticity of substitution parameter ( $\rho$ ) which are exogenous.

Since the objective of producers is to maximize profit subject to the technology, equation (X2) gives the first order condition for profit maximization in the model.

$$WF_f * WFDIST_{f,a} = PV_a * ad_a * \left[ \prod_f \delta_{f,a}^\lambda * FD_{f,a}^{-\rho_a^\lambda} \right]^{\left( \frac{1+\rho_a^\lambda}{\rho_a^\lambda} \right)} * \delta_{f,a}^\lambda * FD_{f,a}^{(-\rho_a^\lambda - 1)} \quad (X2)$$

According to this equation, activities demand factors ( $FD_{f,a}$ ) at the point where marginal cost of each factor ( $WF_f * WFDIST$ ) is equal to the marginal revenue product (net of intermediate input costs) of the factor.  $WFDIST$  is the wage price ratio (wage distortion factor) for factor  $f$  in activity  $a$ ; it makes provision for the fact that different activities may be factor specific, such that the same type of factor may be paid different wages in different sectors.

The CES technology is employed to combine aggregate value added, given the imperfect elastic ties that exist between factors. In addition to the CES production function, the model uses a Leontief technology to combine intermediate inputs and aggregate value added.

$$QINTD_c = \sum_a comactco_{c,a} * QX_a \quad (X3)$$

This nesting means that quantity of commodities used as intermediate input by activities ( $QINTD_c$ ) is derived by multiplying the quantity of activity output ( $QX_a$ ) by the input-output matrix coefficients (fixed intermediate input coefficients),  $comactco_{c,a}$ .

Households' consumption expenditure in this model are allocated across different commodities according to Linear Expenditure System (LES) demand functions. For a developing country such as Botswana, a Stone-Geary utility function is preferred because it allows for subsistence consumption expenditures which are likely to exist, especially for poor households.

The underlying utility function, U defined as Stone-Geary utility function and LES demands is given as follows:

$$U = \prod_{i=1}^n (q_i - c_i)^{\beta_i} \dots\dots\dots(1)$$

where:

Committed expenditures are  $c_i$ , income is  $y$ .

Let discretionary purchases be  $z_i = q_i - c_i$ .

Income available for discretionary purchases is then  $y - \sum_{i=1}^n p_i c_i$ .

$\beta_i$  is the marginal budget share spent on commodity i.

The demand function is then derived by maximising the Stone-Geary utility function subject to a budget constraint as given by equation (2). That is, the problem may be written as

$$\max \prod_{i=1}^n z_i^{\beta_i} \text{ subject to } y - \sum_{i=1}^n p_i c_i = \sum_{i=1}^n p_i z_i \dots\dots\dots(2)$$

The lagrangean is then

$$\Lambda = \prod_{i=1}^n z_i^{\beta_i} + \lambda \left( y - \sum_{i=1}^n p_i c_i = \sum_{i=1}^n p_i z_i \right) \dots\dots\dots(3)$$

Similarly, on the export side there is imperfect transformation in production between varieties produced for the domestic market and those for foreign markets, which allows divergence between the domestic price of exportable goods and their world prices.

The second stage of the model involves the identification of the components of the transactions recorded in the SAM. Commodities are supplied by domestic production activities and by imports. Imperfect substitutability is assumed for commodities from domestic activities and imports. That is households choose their consumption bundles from a set of ‘composite’ commodities that are aggregates of domestically produced and imported commodities. These ‘composite’ commodities are formed as Constant Elasticity of Substitution (CES) aggregates that make the presumption that domestically produced and imported commodities are imperfect substitutes.

Imperfect substitution between imports and domestic supply sold domestically is captured by the CES aggregation function (T1) in which the composite commodity that is supplied in the domestic market is an aggregate domestic supplies and imports.

$$QQ_c = ac_c * (\delta_c * QM_c^{-\rho_c} + (1 - \delta_c) * QDD_c^{-\rho_c})^{-\frac{1}{\rho_c}} \quad \forall cm \text{ AND } cx \quad (T1)$$

Where

$QM_c$  Imports of commodity c

$QQ_c$  Supply of composite commodity c

$QDD_c$  Domestic demand for commodity c

cm(c) = {imported commodities}

cmn(c) = {non-imported commodities}

cx(c) = {commodities produced domestically}

The aggregation is controlled by the share parameters ( $\delta$ ), the elasticity of substitution parameters ( $\rho$ ) and the efficiency parameter ( $ac$ ).

$$\frac{QM_c}{QDD_c} = \left[ \frac{PM_c}{PDD_c} * \frac{\delta_c}{(1 - \delta_c)} \right]^{-\frac{1}{(1 + \rho_c)}} \quad \forall cm \text{ AND } cx \quad (T2)$$

Thus equation (T2) gives the optimum level of imports to domestic demand given the relative price of imports to domestically supplied commodities ( $PDD_c$ ). This is the point where the ratio of elasticities of substitution of domestic supply and imports equal their price ratio. That is, it is the optimal level of imports to domestic demand given the relative price of imports to domestic demand. This equation reflects the assumption that if the elasticity of substitution parameter is high (greater than 1), then an increase in the price of imports relative to domestic demand price will result in an increase in imports relative to domestic demand. If the substitution elasticity parameters are zero, then a rise in relative of imports to domestic demand will not result in a change imports or domestic supply.

$$QQ_c = QDD_c \quad \forall cmn \text{ AND } cx \quad (T3)$$

But equation (T2) only covers commodities that are traded (imported or supplied domestically). We use equation (T3) to allow for cases where there are no imports, and domestic demand equals composite domestic commodities, this equation being defined for supplied commodities.

This approach, first proposed formally by Armington (1969), allows us to treat domestically-produced and imported goods as imperfect substitutes, so that changes in relative prices lead to limited substitution between domestic and imported goods, and so changes in world prices do not pass through perfectly to the prices of domestic goods.

Similarly on the export side it may be assumed that there is imperfect transformation in production between varieties produced for the domestic market and those for foreign markets, which allows divergence between the domestic price of exportable goods and their world prices. This is represented by the trade equation (T4) below:

$$QXC_c = atc * (\gamma_c * QE_c^{rhot_c} + (1 - \gamma_c) * QDD_c^{rhot_c})^{\frac{1}{rhot_c}} \quad \forall ce \text{ AND } cd \quad (T4)$$

Where

$QXC_c$  = domestic commodity output

$QE_c$  = Exports of commodity c

ce(c) = {export commodities}

cen(c) = {non-export commodities}

cd(c) = {commodities produced AND demanded domestically}

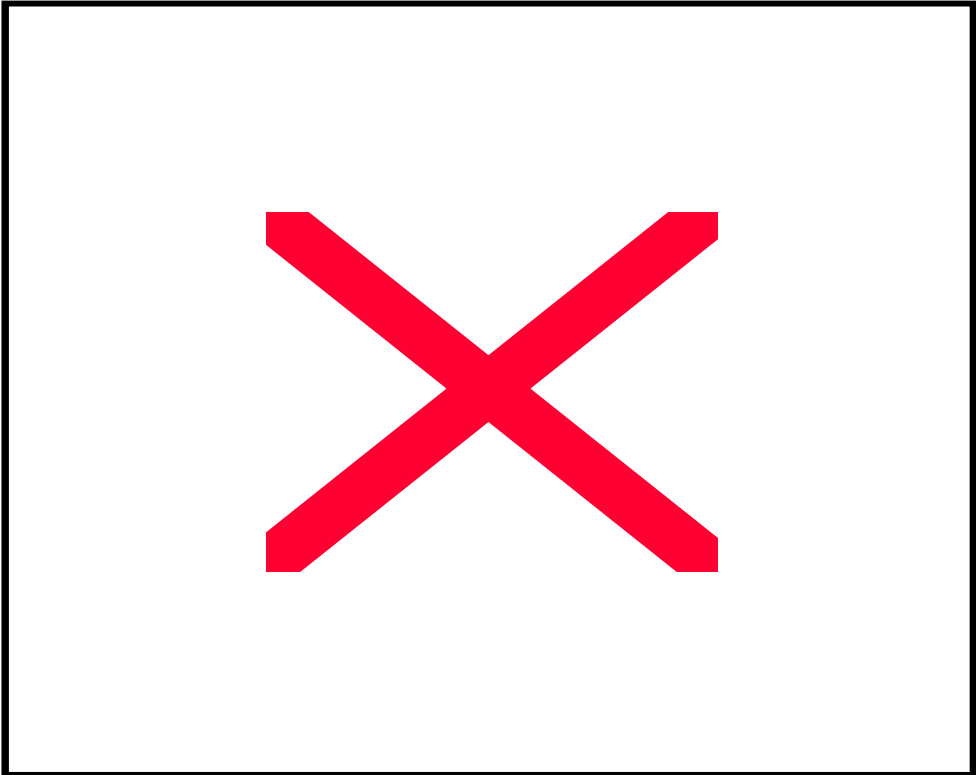
is the output transformation function (T4) which describes how domestic commodity output ( $QXC_c$ ) is allocated between domestic supply and exports; this reflects the assumption of imperfect transformability between domestic demand and exports. The equation (T4) is influenced by the share parameters ( $\gamma$ ), elasticity of transformation parameters ( $rhot$ ) that are exogenous, and efficiency parameters ( $at$ ).

$$\frac{QE_c}{QDD_c} = \left[ \frac{PE_c}{PDD_c} * \frac{(1 - \gamma_c)}{\gamma_c} \right]^{\frac{1}{(rhot_c - 1)}} \quad \forall ce \text{ AND } cd \quad (T5)$$

Equation (T5) gives the optimal mix between exports and domestic demand. This is the point where the ratio of elasticities of transformation of domestic supply and exports equal their price ratio. That is, it is the optimal level of exports to domestic demand given the relative price of exports to domestic demand. This equation reflects the assumption that if the elasticity of transformation is higher, then an increase in the price of exports relative to domestic demand price will result in an increase in exports relative to domestic demand. If the transformation elasticity parameters are zero, then a rise in relative of exports to domestic demand will not result in a change exports or domestic demands.

Thirdly, the model is described by using a pair of figures that show the nature of the price and quantity systems for commodity and activity. The price relationships in the model are described in figure 1.

Figure 1: Price relationships for a CGE model



In Figure 1,  $PQ_C$  is the CES dual price determined by prices for domestic demand ( $PDD_C$ ) and the domestic prices of imported goods ( $PM_C$ ) which are defined as the products of the world prices of commodities ( $PWM_C$ ) and the exchange rate ( $ER$ ) uplifted by ad valorem import duties ( $tm_C$ ). That is,  $PQ_C$  is the consumer price of the composite commodity, which is aggregated from domestic output and imports, subject to the imperfect substitutability that exists between domestic supply and imports. The average prices exclude sales taxes, and hence must be uplifted by ad valorem sales taxes ( $ts_C$ ).

The producer composite price ( $PXC_C$ ) is determined by the prices of domestically supplied commodities and the domestic price for exports ( $PE_C$ ) given the imperfect transformability that exists between domestic demand and exports. The prices received on the export market are defined as the products of the world price of exports ( $PWE_C$ ) and the exchange rate ( $ER$ ) less any export duties due, which are defined as ad valorem export duty rates ( $te_C$ ).

The average price per unit of output received by an activity ( $PX_a$ ) is defined as the weighted average of the domestic producer prices, where the weights are constant. The assumption of leontief technologies for the use of intermediate inputs means that the prices of value added ( $PV_a$ ), are defined as the producer prices less payments for intermediate inputs and production taxes ( $tx_a$ ).

Finally there is a discussion of features intended to capture economic conditions in Botswana and these features are called the closure. These closure rules are those constraints that have to be satisfied by the economic system, but which are not considered in the decisions of any micro agents (Robinson; 1989, pp. 907-908).

It is for that reason that this section would simulate a scenario, that captures the combined welfare effects of the International diamond market shocks (described above) and the export food-processing price shocks.

Thus we run experiments, which combine the food processing simulations conducted in section 5.1. That is we explore the income effects of an external shock resulting from a change in the international price of food processing and minerals.

#### **4.1: Model Closure Rules**

A major closure condition for this group of experiments is holding diamond production in Botswana fixed.

Other closure conditions are as follows:

- For the savings-investment balance, the model treats the investment decision as given: the economy allocates fixed quantities of a set of commodities for investment purposes. Savings adjust to assure that it equals the investment value.
- For the external balance the closure is that the real exchange rate is fixed while foreign savings (the current account deficit) is variable.
- The specification of the closure for the Government account in the base model presumes that all tax rates are fixed at their initial rates and that Government expenditure volumes are fixed, and therefore that Government savings, the internal balance, is a residual.
- Fixing the volumes of commodities demand by enterprises through enterprise savings (CAPENT) to close the enterprise account. This rule allows the value of commodity expenditures by the enterprise account to vary.
- The factor closure rules in this model assumes a more general specification whereby factors are activity specific and allowance has been made for unemployed unskilled labour. Thus the model assumes that labour is mobile across all sectors in the short run and long and that capital is fixed in the short. There is unemployed unskilled labour in both the short and the long run.
- The model specification allows for the consumer price index (CPI) to vary and fix the producer price index (PPI) and the variable ER (exchange rate) in the model. Through this closure we fix the real exchange rate and vary the foreign savings.

#### **5.1: Policy Experiments**

Simulations are carried out by decreasing world's price of food processing and minerals by between 10% and 70% in 7 consecutive steps. And only the results of a price fall of 20%, 30% and 40% in the short run are reported for the macroeconomic variables; and from these results we choose a 30% decline in both the mineral substitutes and food-processing price in the short and long run for interpretation of the results. The closures are as described in section 4.1. But it is important to mention that foreign savings (CAPWOR) is fixed in this experiment, in spite of the fact that this might distort our welfare results. The reason for that is, given the leading role mineral exports play in the economy, it is advisable to allow CAPWOR to vary so that it can absorb the mineral shock.

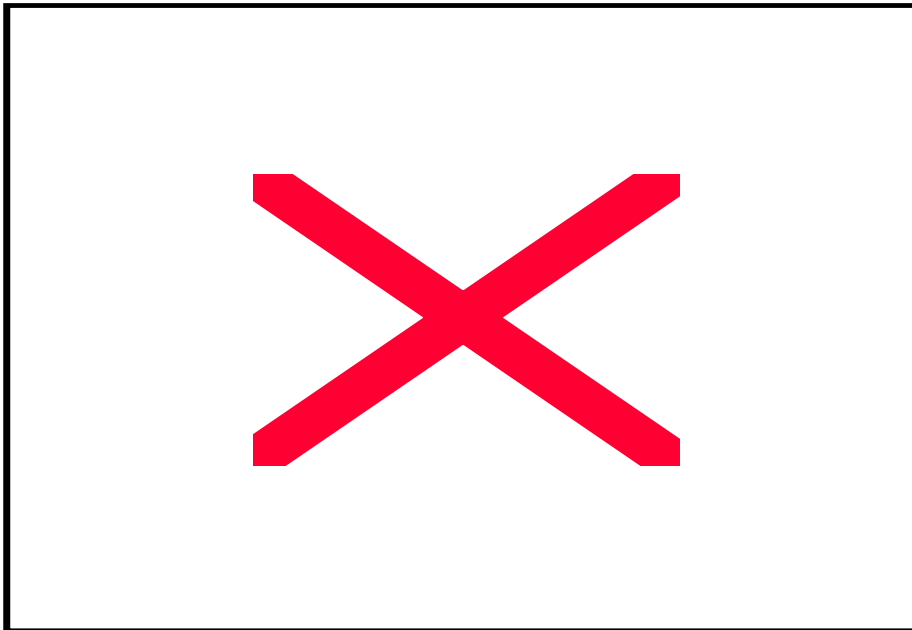
These results are expected to indicate that these shocks have negative welfare effects. This is because the food-processing industry has one of the strongest linkages with the agricultural sector, where majority of the population earn their living; and the mineral sector on the other hand

has the strongest fiscal linkages in as the largest source of foreign earnings for the country. A decline in the international prices of these two export commodities is likely to disproportionately affect both urban and rural households.

### 5.1.1: Macroeconomic Results

These results conform to the outcome of the previous results of the fall in the international price of mineral substitutes. There is a decline in the macroeconomic variables with the reduction in world prices of both minerals and food processing by 30%. Real Gross Domestic Product (GDP) Value Added decreases from a base value of P10.13b (US\$ 2.1b) to P8.88b (US\$ 1.78b). This indicates that the impact of the shock is felt through its impact on the mineral sector rather than the food-processing sector. Note that minerals alone account for more than 94% of total exports, and the impact of the shock resulting from the collapse of the export prices of minerals overshadows the impact of all other export sectors, including food-processing. The only effect the food-processing shock has is felt through income distribution.

*Figure 1: Macroeconomic Variable Changes (Pula, billions)*



There is a deficit of P0.06b (US\$0.012b) on the current account due to the fact that with the fall in the world prices for minerals, foreign savings, which highly depend on mineral earnings, decline. Government savings decline from a base value of P1.56b (US\$0.312b) to P0.87b (US\$0.174b) with a 30% world price fall of exports. This fall in government savings are relatively high and indicate the fact that with the fall in world price of mineral exports, a small open economy such as



Botswana which depend mainly on minerals as a source of foreign earnings and government revenues would face a serious fiscal problem with the shock. Since government expenditure is fixed, government is forced to run down its savings to maintain expenditure.

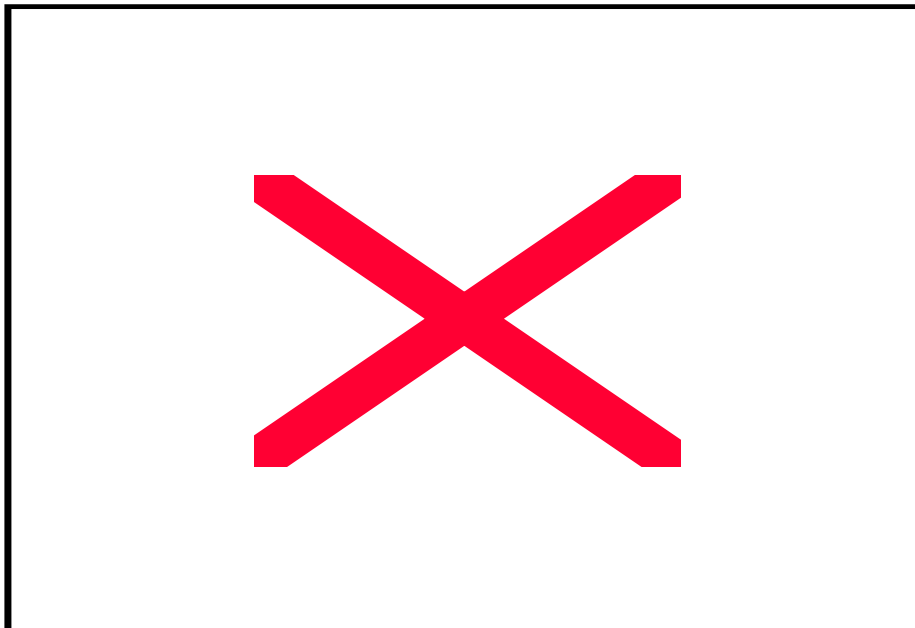
### 5.1.2: Income Distribution Implications

The most interesting results for this simulation are the income distribution effects of the shock. The food-processing sector, which is labour intensive in Botswana, has linkages with a number of sectors, most of which are labour intensive too. And a fall in the international price of food-processing would create a high level of unemployment in the country. On the other hand the mining sector is the largest contributor to GDP and it is the largest contributor to government revenues. And the government of Botswana is the largest employer, saver and investor and the second largest economic sector. In addition, the government is a major consumer of goods and services produced by other sectors. Thus, a fall in the international price of mineral would result in a fall in government revenues and hence a contraction of the economy as shown through the macroeconomic results. Thus even though direct linkages between the mining sector and the rest of the domestic economy are limited in Botswana partly because of its low labour absorption; there is still a linkage through the revenues generated for government and use of factor incomes.

To discuss these welfare implications of the shock we look at the factor income results, household income results and the factor demand results. The results are influenced by the factor closures.

The factor income results (Figure 2) show a fall in the income of all factors of production at 30% price reduction. Capital experiences the biggest fall in income; something expected given that the mineral sector is highly capital intensive. This is followed by the fall of 6% in skilled labour income. Other factor incomes fall marginally.

Figure 2: Percentage changes in Factor incomes (%)



Generally the result indicates that there is a negative welfare effect if the prices of diamond exports and those for food-processing were to fall. But note that much of the welfare effects would be felt most by those factors employed in the food-processing sector. The mineral sector is assumed not to change its level of production; thus the impact of a fall in factor income resulting from the fall in mineral export prices could be explained by the fiscal linkages the sector has with other sectors, particularly Government.

With the fall in factor income, the household incomes are bound to fall. The results in Figure 3 shows that the rural household experiences the largest fall in income by 3.6% in the long run. This again maybe explained by the fact that with the closure assumption of unemployment in the unskilled labour, a contraction of the economy is more likely to be felt more by those who are likely to own this type of labour, the rural household. And with the income elasticities of rural households greater than 1 for most of the sectoral commodities, it might be necessary to consider a compensatory policy targeting the rural households, given that it more likely to support the rural economy.

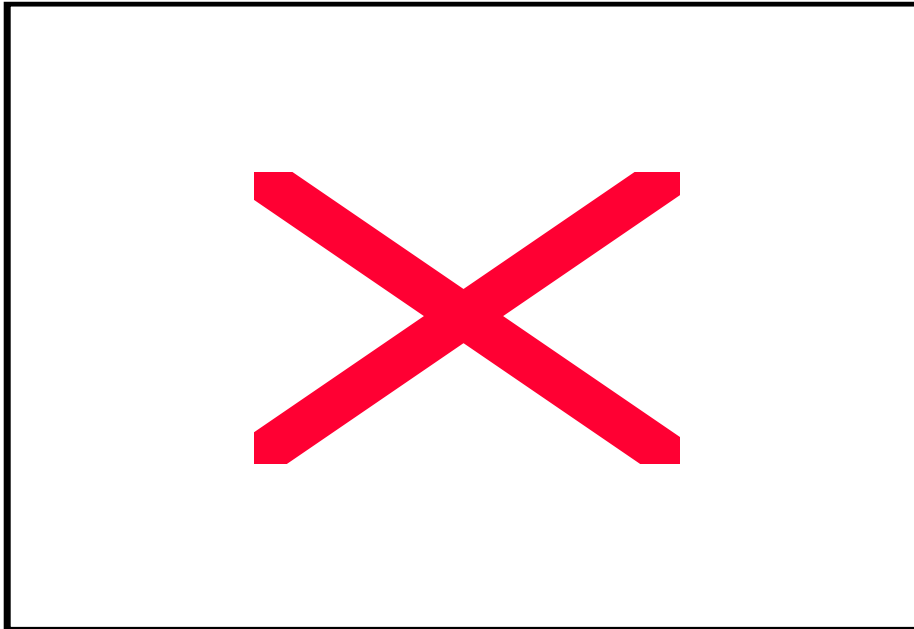
But the other households too experience a fall in their incomes. The non-citizen and urban household are more likely to own skilled labour and capital input, and a fall in the incomes of these factors, as indicated in Figure 2, would disproportionately affect the incomes accruing to these households.

These results give credence to the argument that diversification of the economy in Botswana has not been a success so far; and that much of what has been achieved so far, is still very much tied to the performance of the primary export commodities, minerals and food-processing. That is why there has been a call for the Government to look into the promotion of alternative sources of economic growth such as tourism and the financial sector.

Given that Botswana's agriculture currently enjoys substantial protection, additional international price shocks are likely to have a detrimental impact on rural households, including the bulk of the poor population. This means that policy makers may consider the introduction of complementary domestic policies that compensate those who lose from changes in trade policies. These domestic policies may be in the form of an income transfer program where rural households are compensated for reduced protection of agricultural markets. By making payments proportional to assessments of past earnings in agriculture, the program would be aimed at being non-distortionary in terms of current production decisions.

Figure 3: Household Incomes (%)

### 6.1: Concluding Remarks



The analyses has revealed that Botswana needs to diversify its economy so that other alternative sources of export earnings are developed besides minerals and food processing. This is even more necessary given the fact that the mineral sector does not have strong direct linkages with other sectors, in the form of employment generation and domestic production of goods, with the rest of the economy.

However, the results have also shown that past economic diversification in Botswana has not been much of a success because it is based mainly on the food processing sector and textiles. These two sectors seem to be surviving at the moment, mainly because of favorable trade arrangements in the form of no-reciprocity free entry into the international market. This is likely to change in the future as countries move closer to full compliance with the WTO trade agreement. Though this might be far in the future, especially for textiles, food-processing exports are likely to face more competition after 2008.

Generally, it has been shown that the economy is dependent mainly on Government as the largest employer, saver and consumer of domestic goods. This current position of the Government is made more possible because of the flow of mineral and to a lesser extent food-processing revenues. With the fall in the mineral revenues the Government is most likely to experience a serious budget deficit and this would ripple throughout the economy. Given the changing international trade environment, which put the future of these traditional sources of export earnings in difficulties, it is imperative that the diversification base is extended to encompass other sectors such as tourism and finance.

Finally it should be noted that the closure conditions in the model have influenced the results; this is especially so with regard to the income distribution results. The income distribution results may

be distorted because of the assumption of a variable foreign savings account. But as explained above, given the nature of the Botswana economy, any major shock on the mineral sector-say a 30% cut in export price for minerals- will affect the economy tremendously and the CAPWOR would have to be unfixed.

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