MACRO AND MICRO EFFECTS OF RECENT AND POTENTIAL SHOCKS TO COPPER MINING IN ZAMBIA

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Abstract

As a result of Zambia's dependence on copper mining, both the falling world copper price and the possible withdrawal of investment from the mining sector might seriously threaten economic growth and stability. Accordingly, the impact of a 20 percent reduction in world copper prices and a complete collapse of the copper mining sector are modeled using a 1995 computable general equilibrium model for Zambia.

Results indicate that the fall in world copper prices will place significant pressure on non-mining exports, with much of the burden of raising foreign exchange falling on the food, beverages and tobacco, and textiles and garment sectors. However, the agricultural and agro-related industries are the most export-responsive (albeit from initially low levels) to the forced depreciation of the currency.

The complete collapse of copper mining in Zambia is shown to have a substantial and negative impact on the economy. The fall in production and exports for this important sector leads to a considerable depreciation of the currency in order to fill the resulting gap in foreign earnings. In the short-run, real GDP is reduced by as much as 16 percent. Although the largest increase in exports arises within the food, beverages and tobacco sector, the agricultural and agro-related sectors show considerable potential as sources of foreign exchange earnings.

It is found that both the fall in world prices and the reduction in mining output lead to a fall in total real household consumption. However, given that rural households derive a relatively high share of their income from tradable sectors that benefit from the depreciation, the shocks lead to a progressive redistribution of household incomes and consumption.

The impact of providing an injection of foreign exchange into the country is found to involve a trade-off between alleviating the negative welfare effects of the copper mining shocks and the provision of incentives for structural adjustment. Furthermore, targeted capital investment in highly export-responsive sectors reduces the necessary depreciation of the real exchange rate, and the need for structural adjustment in other areas of the economy.

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I. Introduction

Despite being only the sixteenth largest producer of copper in the world (World Bank, 2000) this commodity is critically important for the Zambian economy. Much of the country's domestic and foreign earnings are reliant on the fortunes of the mining sector, which in turn is dominated by the performance of copper and its by-products. However, substantial drops in the world price of copper and the threatened closure of some of the sector's mines, has led to concerns over the future prospects for the Zambian economy. In response to these concerns, this report presents initial findings on the economic impact of falling world copper prices and a forced contraction of mining sector production. This economy-wide assessment is done using a computable general equilibrium (CGE) model of the Zambian economy for the year 1995.

II. Background

The structure of Zambian production is described in the country's 1995 social accounting matrix (SAM) (Hausner, 1999), and a summary is presented in Table 1. Several important features of the metal mining industry can be seen from this table. The mining sector is the second largest sector in the Zambian economy, accounting for over 17 percent of value-added and 12 percent of total production. Perhaps more importantly, the mining sector generates over 78 percent of the country's total export earnings, with 97 percent of domestic mining output being sent abroad. Of the remaining sectors in the economy, those with significant export-intensities include tourism, tobacco, coffee, and energy.

Despite the importance of mining, both in terms of its contribution to production and to export earnings, this sector does not account for a large portion of total labor employment. This under-representation is explained by the high capital-intensity of mining production. As shown in Table 2, over 86 percent of total factor income in this sector is attributable to capital (including returns to the natural resource).

Table 3 shows the distribution of factor incomes across the different sectors of the economy. From the table it appears that a majority of unskilled and primary-skilled labor and all of land incomes are concentrated in the agricultural and agro-related sectors (with the exception of trade and transportation services). Conversely most secondary and post-secondary-skilled labor incomes are generated in the services sectors (with the exception of metal mining). Although most of the country's capital incomes arise in the tertiary sector, the mining sector is the largest individual sector in terms of capital income.

Tables 4 shows that metropolitan high income households are largely dependent on the returns they receive from their non-agricultural and mining resource capital endowments. Furthermore, Table 5 shows that these households are the largest recipient of the returns to non-agricultural capital and high-skilled labor. In contrast, despite being the only recipients of returns to agricultural capital and land, rural households derive a majority of their income from their endowment of the two least educated labor categories.

Zambia's reliance on the mining sector raises obvious concerns regarding the sustainability of this dependence, as well as the stability of an economy whose foreign earnings are dominated by trade in a single commodity. In recent years there has been a substantial decline in world copper prices (see Figure 1). Since copper mining accounts for most of the Zambian metal mining sector, the fall in prices by almost 50 percent since the 1995 peak has placed significant strain on the Zambian economy. Furthermore, copper mining in Zambia has recently been jeopardized by a threatened withdrawal of investment by a large international mining company, which might well result in the closing of the copper mines.

III. Data and Model Structure

A detailed description of the model used for Zambia can be found in Lofgren *et al.* (2001). This class of model has developed from the neoclassical-structuralist modeling

tradition originally presented in Dervis, de Melo and Robinson (1982).

Model Description

The model, following the Zambian database, distinguishes between 28 productive sectors and the 27 commodities that they produce (as shown in Table 6).[1] This distinction allows individual activities to produce more than a single commodity and conversely, for a single commodity to be produced by more than one activity. The model identifies 8 factors of production. These include four types of labor (unskilled, primary education, secondary education and post-secondary education); three types of capital (agricultural, mining resources and other capital); and finally the factor land.[2] Producers in the model make decisions in order to maximize profits. Production technology is represented by a constant elasticity of substitution (CES) production function in primary factors. These factors are combined with fixed-share intermediates using a Leontief specification. Profit maximization implies that factors receive income where marginal revenue equals marginal cost based on endogenous relative prices.

Substitution possibilities exist between production for the domestic and the foreign markets. The decision of producers is governed by a constant elasticity of transformation (CET) function which distinguishes between exported and domestic goods, and captures differences between the products sold in the two markets. Profit maximization drives producers to sell in those markets where they can achieve the highest returns. These returns are based on domestic and export prices (where the latter is determined by the world price times the exchange rate adjusted for any taxes). Under the small-country assumption, Zambia is assumed to face a perfectly elastic world demand at a fixed world price. The final ratio of exports to domestic goods is determined by the endogenous interaction of relative prices for these two commodity types.

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[1] Table 7 further disaggregates each activity into its component categories.
[2] The breakdown of capital into three component parts is an extension from the original SAM described in Hausner (1999).

Further substitution possibilities exist between imported and domestic goods under a CES Armington specification. Such substitution can take place both in final and intermediates usage. The Armington elasticities vary across sectors, with lower elasticities reflecting greater differences between domestic and imported goods (see Table 8 for a list of elasticity values). Again under the small-country assumption, Zambia is assumed to face infinitely elastic world supply at fixed world prices. The ratio of imports to domestic goods is determined by the cost minimizing decision-making of domestic demanders based on the relative prices of imports and domestic goods (both of which include relevant taxes).

The model provides for four types of households, two types of enterprises, and the government. Household categories include low and high-income metropolitan households, other urban households, and rural households. The two enterprises are mining enterprises and non-mining enterprises.[3] Households and enterprises receive income in payment for producers' use of their factors of production. Both institutions pay direct taxes to government (based on fixed tax rates), save (based on fixed marginal propensities to save), and make transfers to the rest of the world. Enterprises pay their remaining income to households in the form of dividends.

The government receives income from imposing activity, sales and direct taxes, and import tariffs, and then makes transfers to households, enterprises and the rest of the world. The government also purchases commodities in the form of government consumption expenditure, and the remaining income of government is (dis)saved.

All savings from households, enterprises, government, and the rest of the world (foreign savings) are collected in a savings pool from which investment is financed.

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[3] The distinction between mining and non-mining enterprises is another extension of the Zambian SAM. In separating mining from non-mining enterprises, it was assumed that a significant portion of total earnings remitted abroad is attributable to the mining enterprises (75 percent). This is based on the assumption that the mining sector is more reliant on foreign capital investment.

Closure Rules

The model includes three broad macroeconomic accounts: the government balance, the current account, and the savings and investment account. In order to bring about balance between the various macro accounts, it is necessary to specify a set of 'closure' rules which provide a mechanism through which macro balance can be achieved.

A 'balanced' macro closure was assumed in order to balance the Zambian savings-investment account. Adjustments in absorption are spread evenly across all of its components (household consumption, investment, and government consumption) so that the nominal absorption shares of investment and government consumption are fixed at base levels. In order to generate savings that equal the cost of the investment bundle, the base-year savings rates of non-government institutions are adjusted.

For the current account it was assumed that a flexible exchange rate adjusts to maintain a fixed level of foreign savings (defined in foreign currency). In the government account, government savings are assumed to be flexible. Finally, the domestic price index was chosen as the numéraire.

In factor markets, it was assumed that unskilled labor faces unemployment and is paid a fixed real wage under the condition of a perfectly elastic labor supply.[4] For the remaining three labor categories it was assumed that aggregate employment is fixed and that wages are free to adjust. This latter option was also chosen for the remaining (capital and land) factors.

Simulations

In order to assess the impact of changes in the world copper price and the possible closing down of mining production, we defined two simulations:

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[4] The fixing of real wages, as opposed to nominal wages, is an extension of the model described in Lofgren *et al.* (2001).

- A 20 percent reduction in the world price of copper

- A 75 percent reduction in the output of the mining sector (thereby effectively simulating a complete collapse of Zambian copper mining)

These two simulations were run under two alternative sets of assumptions. The first is aimed at assessing the short-run impact of these shocks on the Zambian economy, while the second is concerned with a long-run assessment. For the short run it was assumed that the capital stock in all activities is fixed while the remaining factors are free to shift between activities. In the long run, the capital stocks of individual activities were free to adjust, with the exception of the mining, tobacco, energy, and tourism sectors. For the mining sector it was assumed that, in the long run, while non-resource capital should be mobile between sectors, resource capital is specific to mining and therefore cannot be redeployed into the production of other commodities. For the tourism, energy, and tobacco sectors it was assumed that these activities lack the infrastructure to greatly increase their output.[5] Growth is still possible through the substitution of capital for other factor inputs. Finally, in the short run it was assumed that the substitution possibilities between factors are limited, while, in the long run, factor substitution elasticities are higher, making production technology more flexible.

The results from the drop in world copper prices and the collapse of copper mining output are discussed in turn below.

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[5] Initial investigations with the model showed these sectors to be unrealistically responsive to changes in the structure of the Zambian economy. While this would indicate that such sectors are worth further consideration (see Section VI), the model results were considered unrealistic based on the performance of similar industries in other countries within the region.

IV. Results from the Simulated Drop in World Copper Prices

Given the recent and continuing fall in world copper prices, the first simulation assesses the impact on Zambia of a fall in the world price of copper exports. In line with the description of the simulations in the previous section, Tables 9 to 11 present the results from this simulation.

Short-run Scenario

The results for the short-run scenario are presented in Tables 9 and 10. The initial impact of a decrease in the world price of copper is to reduce the value of export earnings in the mining sector. Mining is by far the largest source of export earnings for Zambia, accounting for over 70 percent of the total value of exports. This drop in the value of exports for the mining sector therefore puts pressure on the current account deficit. However, since it is assumed that there are no additional foreign borrowing options for Zambia, this pressure leads to a depreciation of the real exchange rate, which increases export incentives and reduces import incentives. The result is a 10 percent depreciation of the real exchange rate, which increases the domestic prices of traded commodities, increasing exports and reducing imports. At the new equilibrium, total exports rise by 4.1 percent and total imports are reduced by 5.6 percent.

The effect of the adverse change in international prices is to reduce the level of absorption in the Zambian economy by 4.2 percent. In real terms, the level of investment falls by a greater amount than the other components of absorption. This result is due to the import-intensive nature of investment. The fall in the real value of investment as a result of increased import prices also places downward pressure on absorption. Real GDP at market prices falls by 0.7 percent, while the current account deficit as a percentage of nominal GDP increases by 2.3 percent as a result of the real depreciation.[6] Changes in household consumption are discussed below.

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[6] For this set of simulations, real GDP changes are primarily due to changes in the employment of unskilled labor. For other factors, employment is fixed. For the second set of simulations involving

The impact of the fall in world copper prices on specific sectors within the Zambian economy is shown in Table 10. The values shown in the table are quantity and not value changes. Continuing with the short-run scenario, the importance of the drop-off in the value of metal mining exports is immediately apparent from the substantial share of export quantities attributable to the mining sector. The fall in mining export earnings places considerable pressure on the remaining sectors to increase their level of exports. Following the depreciation of the currency, the sectors that increase exports are, in order of importance:[7]

- Food, beverages and tobacco (10.9 billion Kwacha or 71 percent growth)
- Textiles and garments (6.6 billion Kwacha or 39.7 percent growth)
- Other manufactures (4.7 billion Kwacha or 20.2 percent growth)
- Capital goods (3.6 billion Kwacha or 37.5 percent growth)
- Financial services (2.1 billion Kwacha or 9.5 percent growth)

While the above sectors increased their exports by the largest absolute amount, this is largely due to growth from larger initial export shares. Other sectors with smaller initial shares but with more significant export growth include:

- Livestock products (0.7 billion Kwacha or 63.7 percent growth)
- Wood and wood products (1 billion Kwacha or 54.5 percent growth)
- Other crops (1.5 billion Kwacha or 51.8 percent growth)
- Forestry (0.04 billion Kwacha or 51.4 percent growth)
- Horticultural crops (1.9 billion Kwacha or 46 percent growth)

The depreciating currency reduces the level of imports. On a sectoral level, the sectors most affected in absolute terms by this depreciation are:

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a drop in mining output, real GDP changes are larger since they also involve reductions in the use of natural resource capital in the mining sector.
[7] All absolute changes in this report are in 1995 prices.

- Capital goods   (22.8 billion Kwacha or 6.2 percent decline)
- Financial services   (8.2 billion Kwacha or 4.3 percent decline)
- Food, beverages and tobacco (7.5 billion Kwacha or 13.9 percent decline)
- Other manufactures   (6.9 billion Kwacha or 2.9 percent decline)
- Trade/transportation services (5.5 billion Kwacha or 5.6 percent decline)

Again as with exports, the ranking of import changes in absolute terms hides the greater movement amongst other products. As with exports, these more responsive commodities include largely the horticultural crop and agro-related products.[8]

Long-run Scenario

The purpose of the long-run scenario is to explore the impact of a drop in mining output in a setting where factors are more mobile, in the process giving some insight into how the structure of Zambia's economy adjusts. More specifically, under the long-run scenario, capital is mobile between sectors (except in the case of mining resources and the tourism, tobacco, and energy capital stocks). This implies that not only is it possible to shift production towards those sectors with the greatest export potential, but that the non-resource capital of the mining sector is free to migrate to other sectors. This non-resource capital amounts to 6.3 percent of Zambia's total capital stock.

The results for the long-run scenario are also presented in Tables 9 and 10. The impact of the fall in world copper prices is lessened under this scenario as the economy is assumed to be able to adjust production and trade more easily, reducing the depreciation that is needed to restore the external balance. As in the short run, the fall in exports following the drop in world prices reduces the value of exports in the mining sectors and places pressure on the remaining sectors to increase exports. In the long run, however, this shift in production towards exporting sectors is made easier by the mobility of capital across sectors. Those sectors that are more prone to increasing their exports grow by a larger

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[8] The sensitivity of changes in exports and imports to changes in the trade elasticities are presented in the appendix.

amount in the long-run case since they are now assumed to be able to acquire more easily the capital necessary to increase production. As a result, the sectoral composition of change is less geared to a few key sectors (as was the case in the short-run). This can be seen in Table 6 below were export and import changes are more evenly spread out across the sectors. Key differences lie in the greater drop in imports and rise in exports amongst the agricultural activities, and the substantial increase in export quantities from the capital goods sector.

In the long run, the ability to shift between factor inputs, and to move factors more easily into sectors that are better geared to generate export earnings, reduces the need to depreciate the real exchange rate by as much as in the short-run scenario. Consequently the fall in imports is lessened, as is the drop in real absorption. The results suggest that while in the short-run the relief from the fall in world prices is likely to originate in the manufacturing and services sectors, in the long-run greater potential for diversification lies amongst the agricultural sector and related industries.

Impact on Households

The results from the short- and long-run scenarios indicate that total absorption and household real consumption decline following the fall in world copper prices. However, the burden of this change in consumption is not distributed evenly across households. Rather, the overall welfare effect on households depends on initial household factor endowments and the changes in these factors' incomes following the world price shock.

According to Table 9, the short-run negative impact on real household consumption is progressive. High-income metropolitan households' real consumption is reduced by 7 percent, while that of rural households falls by only 2.4 percent. In the long-run scenario, all households are better off compared to the short-run scenario, although the lower fall in household consumption is relatively more significant for the rural households.

The progressive results described above are mainly driven by the differing factor

endowments of each household category. As described in Section II, poorer households derive a large portion of their income from unskilled and primary-skilled labor, whose returns increase in both the short- and long-run scenarios as a result of the shift in production towards agriculture. Furthermore, increased production in the agricultural sector increases the demand, and hence returns, to land, whose income is earned solely by rural households. By contrast, high-income metropolitan households earn a substantial portion of their income from mining-resource capital, whose returns decline following the world price shock. This fall in mining capital returns increases in the long-run scenario but is offset by rising returns to higher skilled labor resulting from the additional growth in the non-agricultural non-mining sectors. Therefore, while factor returns change between the short- and long-run scenarios, the progressive nature of the world price shock is evident in both scenarios.

The Impact of Additional Foreign Borrowing

Up to this point it has been assumed that the level of foreign savings (or the current account deficit) has been fixed. As such, the adjustment in response to the fall in copper world prices has been forced to originate from within the domestic Zambian economy. However it is possible to alleviate some of the short-term pressures placed on the economy by extending the country's ability to borrow abroad.[9] The following simulation, whose results are shown in Table 11, continues from the short-run scenario presented above and attempts to gauge how additional funds from abroad might lessen the impact of a 20 percent fall in copper prices.

Table 11 below presents the results from the same short-run simulation in Table 9 above. Starting from the base-year values, the Zambian economy is shocked with a 20 percent decrease in the world price of copper. Initially it is assumed that foreign borrowing is fixed, and column three therefore reproduces the results from Table 9. The following

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[9] No distinction is made between the various possible sources of the foreign exchange (e.g., between increased foreign borrowing or foreign aid).

columns show the results when foreign borrowing (in foreign currency) is gradually increased by 5 percent of Zambian base-year export earnings.

As in the previous simulations, the initial impact of falling world prices is to reduce the value of the mining sector's export earnings and thereby place pressure on the current account. However, in the simulations below, this pressure is partially alleviated by increased borrowing from abroad. Since it is now not necessary to reduce the trade deficit by as much as in the previous simulations, the effects on exports, imports, and the exchange rate are reduced.

The results show that an injection from abroad approximately equal to between 10 and 15 percent of initial total export earnings is sufficient to offset the negative effect that the fall in prices has on the exchange rate. If more than this amount is injected into the Zambian economy, then the effect of the shock becomes positive, with real GDP growing by 0.2 percent in the case of an increase in foreign savings at 20 percent of the value of export earnings. Furthermore, the currency begins to appreciate. Finally real consumption for the poorest household category starts increasing after a 10 percent increase in foreign savings.

While this approach might lessen the immediate impact of the shock, serious questions of sustainability arise when it is considered that the trade deficit continues to rise by a greater amount in each of the simulations presented below.[10] Furthermore, the current account deficit rises considerably, from around 13 to over 20 percent of nominal GDP.

V. Results from the Simulated Drop in Mining Sector Output

Given the threatened withdrawal of foreign investment in the mining sector, this study also assesses the impact on the Zambian economy of a complete shutdown of copper

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[10] It should be noted that the closure rule discussed in the previous section refers to a fixing of foreign savings in foreign currency. Therefore while the deficit does not change in the standard short and long-run simulations due to the closure rule, it is allowed to change in this simulation since the amount of foreign borrowing has increased.

mining activity, which accounts for around 75 percent of the total mining sector. Accordingly the simulation imposes a reduction of metal mining activity's output by that percentage. As in the previous simulation on world prices, this section presents the results for both short- and long-run scenarios, and these can be found in Tables 12 and 13.

Short-run Scenario

As already stated, the mining sector accounts for 17 percent of total value added in the Zambian economy. A 75 percent reduction of this sector's output is a substantial shock to the economy, and given that 97 percent of domestic output is exported, this shock is particularly severe in terms of reduced export earnings. Since it is assumed that 80 percent of the mining sector's capital stock consists of natural resources that are specific to the mining sector, the reduction in output also significantly reduces the amount of productive capital within the country (by 19 percent of the total capital stock).

Given the high export-intensity of the mining sector and its three-quarter share of total exports, Table 12 shows that the initial impact of a reduction in this sector's output is to severely reduce Zambia's export earnings. This puts pressure on the trade deficit, which forces a depreciation of the exchange rate of 42.1 percent. This depreciation encourages other sectors within the economy to increase exports, while at the same time discouraging imports. According to the simulation, the final equilibrium effect on the trade flows of Zambia is a 33.9 percent reduction in total real exports, a 203.4 percent increase in non-mining exports, and a 21.7 percent reduction in imports.

As already stated, the fall in mining output creates a need for additional exports from the remaining sectors within the economy. Table 13 shows the changes in import and export quantities as a result of a 75 percent reduction in mining output. Given that the remaining sectors account for less than a quarter of total initial export quantities, the non-mining sectors expand considerably following the collapse of the mining sector and the release of labor from mining.

The sectors that perform the best in terms of absolute increases in export quantities are:

- Food, beverages and tobacco (65.9 billion Kwacha or 429.5 percent growth)
- Other manufactures (25.8 billion Kwacha or 110 percent growth)
- Textiles and garments (23.5 billion Kwacha or 142.5 percent growth)
- Capital goods (16.3 billion Kwacha or 170.9 percent growth)
- Energy (13.2 billion Kwacha or 23.4 percent growth)

While these sectors out-performed others in generating the necessary export revenue, they were doing so from initially higher export shares. While from a lower base, the sectors with the highest growth rates were largely those from the agricultural and related sectors (including food, beverages and tobacco, livestock, horticultural crops and other crops). However this general shift to the agricultural and related sectors is less pronounced than under the previous simulation of a drop in world copper prices.

Long-run Scenario

The long-run results for this simulation are presented in Tables 12 and 13. The inter-sectoral mobility of capital in the long-run scenario greatly reduces the export pressure on those non-mining sectors with initially high capital endowments. Available capital allows other more export-intensive sectors to share the burden, and this is seen in Table 13 by the smaller fall in exports in the long-run scenario. Given this greater export responsiveness, the real exchange rate depreciates by 25.3 percent, and consequently, the fall in imports is lower than in the short-run. Absorption is reduced by 7.6 percent with real GDP at market prices falling by 11.6 percent.[11]

On a sectoral level the best long-run performing export sectors in terms of absolute changes in export quantities are:

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[11] The substantial fall in real GDP is mainly due to the reduction of Zambia's productive capital stock. Prior to the shutdown of the mining sector, the stock of mining resource capital was being utilized in the production process (and was thus contributing to real GDP). However, following the shock, this capital is lost to the production process since it is not mobile between sectors.

Textiles and garments	(67.7 billion Kwacha or 409.7 percent growth)
Capital goods	(59 billion Kwacha or 617.4 percent growth)
Food, beverages and tobacco	(34.3 billion Kwacha or 223.4 percent growth)
Other manufactures	(30.2 billion Kwacha or 128.5 percent growth)
Tourism	(15.3 billion Kwacha or 48.7 percent growth)

Of these, the sectors with notably high export growth include textiles and garments; capital goods; and food beverages and tobacco.

Impact on Households

As in the previous simulation involving falling world copper prices, Table 12 shows that the rural households are cushioned from the negative effects of shutting down the mining sector by their land and agricultural capital endowments. By contrast, the initial importance of mining capital income for high-income metropolitan households results in a large drop in household incomes and real consumption following the collapse of the copper mining sector. Overall, rural households' real consumption falls by 4.1 percent as opposed to a 13.7 percent fall for high-income metropolitan households.

In the short-run, the income of the metropolitan households also suffers from the drop in production in the mining sector, which greatly reduces the demand for higher-skilled labor. However, in the long run, production is able to shift into other sectors and this raises the demand and returns to these two labor categories. This is particularly beneficial for poorer metropolitan households who derive most of their income from these two categories.

For rural households, the improvement in consumption between the short- to the long-run scenarios is less pronounced since returns to their most important factor endowments do not change significantly in the long run. However, higher demand for unskilled labor, resulting from a lower fall in real GDP, improves rural households' welfare in the long-

run scenario. In both scenarios, the complete collapse of the copper mining sector leads to a progressive redistribution of household welfare.

The Impact of Additional Foreign Borrowing

The impact on the Zambian economy of a 75 percent reduction in mining activity is severe. Relaxing the assumption on fixed foreign borrowing allows for the provision of short-term relief but avoids correcting for the Dutch disease that has characterized Zambia in recent decades. Therefore, while it might be desirable in the short-run to alleviate some of the impact of a collapsed mining sector, this assistance would at the same time remove the incentives to restructure the economy. In other words, there exists a trade-off between household welfare and incentives for structural adjustment. Table 14 considers the changes to the above results if Zambian foreign borrowing were allowed to increase.

The second column in the table shows the short-run impact of a 75 reduction in mining output (thus corresponding to the short-run column in Table 12). The following columns show the impact of increasing the level of foreign borrowing from 20 to 60 percent of initial Zambian export earnings, reducing the need to depreciate and adjust exports in response to an increasing trade deficit. This can be seen by the simulated export and import changes.

However, at the same time the additional injection into the economy does alleviate some of the negative welfare impact of a drop in mining output. Increases in foreign borrowing of 40 percent or more of total export earnings are more than sufficient to induce an increase in real absorption. Consequently the drop in real GDP and real household consumption are lessened compared to the scenario without any increase in foreign borrowing. The simulated shift in favor of returns to primary skilled labor is driven by increased production in the drought-tolerant staples, fisheries, forestry, and food processing sectors. The distribution of the returns to primary labor across households is

the driving force behind the changing distribution of real consumption in Table 12.

VI. The Impact of Investment in Targeted Sectors

In the previous simulations it was assumed that the capital stock of the tourism, tobacco, and energy sectors were fixed, thus limiting the responsiveness of these sectors and reflecting likely capital supply constraints. However, these sectors are potential export sectors, and as such might prove likely candidates for targeted investment. In this section it is assumed that, following the fall in world copper prices or a shutting down of the copper mining sector, the Zambian government is able to increase investment in these sectors by increasing the size of their available capital stock. The value of the 1995 capital stock for each of the sectors was:

- Tobacco   (1.8 billion Kwacha or 0.1 percent of the total capital stock)
- Energy   (114.7 billion Kwacha or 9.2 percent of the total capital stock)
- Tourism   (8.5 billion Kwacha or 0.7 percent of the total capital stock)

For each simulation, the size of the capital stock available to these three sectors was increased by 0 to 20 percent in five percentage point increments. There was no change to the capital stock available to the other sectors.

Fall in World Copper Prices with Targeted Investment

The impacts of additional capital investment in the three targeted sectors coupled by a fall in world copper prices are presented in Tables 15 to 18.

The short and long run macroeconomic impacts of a 20 percent fall in world copper prices are shown in Tables 15 and 17 respectively. Each of these tables show the impact on the Zambian economy of scaled increases in the capital stock of the tourism, tobacco

and energy sectors.

The short-run results show that if the capital stocks of these targeted sectors are increased by 20 percent then the overall impact on real GDP of a fall in world prices is no longer negative. Real GDP increases by 0.4 percent as production in these targeted sectors increases following the introduction of new activity-specific capital. Exports from these three sectors increases alongside production while imports decline by less (as shown in Table 16). This reduces the pressure placed on the exchange rate to depreciate, and as such, the fall in total absorption is lessened in the simulations with targeted investment.

From Table 15, the compositional effect of adding capital to the targeted sectors increases the factor income shares of secondary and post-secondary labor (which face increased demand following the expanded output of the targeted sectors). Returns to mining capital fall in the investment scenarios since less pressure is placed on the mining sector to continue production and thereby maintain exports.

In the long run, production and exports in the agricultural and agro-related sectors grow by less than in the short-run scenario (as shown in Tables 17 and 18). This is because the non-agricultural and non-mining activities are able to shift production towards those sectors with the higher export responsiveness. This reduces the pressure placed on agriculture and agro-related industries to fill the gap left by falling mining exports. As in the short-run scenario, total imports drop following the depreciation of the exchange rate, but this fall is lessened by the targeted investment and the resulting increase in real GDP and household consumption.

Fall in Mining Output

The impacts of additional capital investment in the three targeted sectors together with a complete shutdown of Zambian copper mining are shown in Tables 19 to 22.

Tables 19 and 21 show the short- and long-run macroeconomic impacts of a 75 percent

reduction in the level of mining output under varying levels of increased investment in the tourism, tobacco, and energy sectors. Considering again investment equal to 20 percent of the original value of capital, the impact on the macroeconomic aggregates appears to be similar to that of previous section. The increase in investment, in both the short- and long-run scenarios, increases the level of production and exports and reduces imports for the targeted sectors. This reduces the extent of the required depreciation and thereby relieves the pressure placed on falling imports to maintain the current account balance. Absorption decreases by less as investment increases and this leads to a lower overall drop in real GDP of 14.1 percent.

While the level of investment appears to have little impact on the macroeconomic effects of shutting down the copper mining sector, the effects on the growth of exports in the targeted sectors is significant. This is particularly true in the short-run scenario where export growth rates for the energy and tourism sectors increase by 65 and 24 percentage points respectively.

Summary

The 20 percent increase in the capital stock of the tourism, tobacco, and energy sectors is equivalent to an investment equal to 26.2 percent of total private investment in 1995 or 27 percent of current government consumption spending. The high value of this additional investment is explained by the large initial capital stock of the energy sector. While this would represent a substantial increase in investment, the impact on the level of production and exports in these three sectors is significant. Furthermore, increasing the level of investment in the targeted sectors reduces the negative impact of both the fall in world prices and the reduction of mining output on the level of real GDP in the Zambian economy.

VII. Conclusion

Given the importance of the mining sector in Zambian export earnings, a 20 percent fall in world copper prices leads to significant changes within the structure of the Zambian economy. The incentive for structural change arises from depreciation of the real exchange rate. In the absence of foreign borrowing, pressure in the short run will be placed mainly on the manufacturing and services sectors to increase their level of exports, thereby filling the gap left by the falling value of mining exports. In the long run the economy is expected to have a greater ability to adjust to changes in the world commodity markets through the ability to shift capital between sectors, and this adjustment is likely to drive production more toward export-oriented agricultural and agro-related industries. The fall in total consumption is accompanied by a progressive redistribution of incomes and real consumption across households, making the welfare effects of a fall in world copper prices less detrimental for poorer rural households.

A complete shutdown of copper mining represents a more substantial shock to the Zambian economy, and clearly highlights the need to diversify the country's production base. Such structural adjustment is driven by a significant depreciation of the real exchange rate. In the short run it is unlikely that the political and economic structure can withstand the simulated loss of absorption and consumption. In such a case it would seem necessary to supplement the loss in the mining sector with increased foreign borrowing. However this type of support involves a trade-off between alleviating the effects of the collapsed copper sector and maintaining the incentives needed to induce structural adjustment. Although it is difficult to determine using a static CGE model, it would appear that the sectors with the greatest potential for diversification purposes are export-oriented sectors in agriculture and related industries. Again the shift towards these sectors favors poorer rural households, whose real consumption falls by less than that of the higher-income metropolitan households.

Figure 1: Changes in the World Copper Price (1990-2002)

Table 1: The Structure of Production in the Zambian Economy (1995)

Sector	Share of Total Value Added	Share of Total Production	Share of Total Employment	Share of Total Exports	Export Intensity[1]	Share of Total Imports	Import-penetration[2]
			Percentage of Total				
Maize	4.3	3.0	5.8	0.8	10.0	2.5	35.3
Drought-tolerant staples	1.0	0.5	1.3	0.0	0.2	0.0	0.1
Groundnuts	0.4	0.3	0.5	0.0	2.3	0.0	1.0
Sugar	0.3	0.2	0.2	0.0	0.0	0.0	0.0
Cotton	0.5	0.3	0.6	0.2	6.8	0.8	35.0
Tobacco	0.3	0.2	0.3	0.5	34.4	0.1	17.4
Coffee	0.3	0.2	0.3	0.3	29.8	0.0	0.2
Wheat	0.6	0.4	0.6	0.0	0.2	0.5	26.4
Horticulture crops	5.1	2.8	9.4	0.5	5.2	0.3	6.8
Other crops	3.3	1.7	6.2	0.3	5.5	0.4	10.2
Livestock products	1.8	1.9	2.5	0.2	1.1	0.1	1.2
Fisheries	0.9	2.3	0.8	0.0	0.0	0.0	0.1
Forestry	3.9	2.2	4.4	0.0	0.3	0.0	0.2
Metal mining	17.3	12.2	4.7	78.4	96.9	1.2	27.0
Food, beverages and tobacco	6.2	11.3	7.3	1.9	2.8	4.1	9.0
Textiles and garments	1.2	2.9	0.9	2.3	9.9	2.3	18.2
Wood furniture and paper	2.2	2.0	1.6	0.2	1.5	5.9	38.5
Fertilizer, pesticides and basic chemicals	0.4	0.2	0.3	0.1	7.1	4.9	76.8
Other manufactures	1.3	3.9	0.3	2.9	10.4	20.2	53.9
Energy	4.7	3.5	0.7	5.2	27.7	0.0	0.3
Capital goods	1.4	1.7	1.5	1.2	9.6	35.7	80.5
Construction	1.7	6.1	1.5	0.0	0.0	0.0	0.0
Trade and transportation services	20.6	20.7	23.5	0.0	0.0	7.1	7.7
Tourism	1.1	0.6	1.6	2.9	87.8	0.0	0.0
Other market services	3.7	2.4	6.0	0.0	0.0	0.0	0.0
Finance	8.2	7.8	5.8	2.1	4.9	13.8	30.8
Public non-market services	7.3	8.8	11.1	0.0	0.0	0.0	0.0
Total	**100**	**100**	**100**	**100**	**16.6**	**100**	**24.6**

[1]. Export intensity is calculated as the value of exports as a percentage of the total value of output.
[2]. Import penetration is the value of imports as a percentage of total domestic final demand.

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Table 2: Value-added Shares by Factor and Activity (1995)

Sector	Labor (Unskilled)	Labor (Primary)	Labor (Secondary)	Labor (Post)	Capital	Land	Total
			Percentage of Total				
Maize small and emergent	10.4	64.4	0.0	0.0	7.6	17.6	100
Maize commercial	22.7	21.0	0.0	0.0	42.3	14.1	100
Drought-tolerant staples	22.6	44.0	0.0	0.0	3.8	29.5	100
Groundnuts	31.0	34.9	0.0	0.0	10.7	23.4	100
Sugar	16.8	16.3	0.0	0.0	56.1	10.9	100
Cotton	43.9	19.9	0.0	0.0	22.9	13.3	100
Tobacco	45.9	17.5	0.0	0.0	24.9	11.7	100
Coffee	4.9	51.9	0.0	0.0	8.5	34.7	100
Wheat	11.1	38.4	0.0	0.0	24.9	25.7	100
Horticulture crops	3.0	89.6	0.0	0.0	6.4	1.0	100
Other crops	0.9	89.5	5.1	0.0	1.6	2.9	100
Livestock products	5.3	0.0	66.3	0.0	28.4	0.0	100
Fisheries	12.3	27.2	5.7	0.0	54.8	0.0	100
Forestry	0.8	55.0	2.5	0.1	41.7	0.0	100
Metal mining	0.4	2.3	9.3	1.9	86.1	0.0	100
Food beverages and tobacco	18.5	35.3	4.3	1.2	40.6	0.0	100
Textiles and garments	0.3	11.7	24.6	2.2	61.3	0.0	100
Wood furniture and paper	8.5	8.6	17.2	2.7	63.1	0.0	100
Fertilizer pesticides and basic chemicals	0.7	14.3	22.3	4.9	57.7	0.0	100
Other manufactures	0.8	2.3	5.7	3.0	88.2	0.0	100
Energy	0.0	1.5	4.7	1.8	91.9	0.0	100
Capital goods	0.9	13.4	34.1	7.6	44.1	0.0	100
Construction	2.5	16.8	23.1	2.9	54.7	0.0	100
Trade and transportation services	11.8	24.7	18.9	2.6	42.1	0.0	100
Tourism	3.2	25.5	36.9	6.5	28.0	0.0	100
Other market services	3.3	12.2	57.5	10.1	16.8	0.0	100
Finance	4.9	17.3	12.0	2.2	63.6	0.0	100
Public non-market services	2.7	11.0	43.3	20.2	22.9	0.0	100
Total	**6.5**	**25.1**	**15.9**	**3.4**	**47.4**	**1.7**	**100**

Table 3: Factor Shares Across Sectors

Activity	Labor (Unskilled)	Labor (Primary)	Labor (Secondary)	Labor (Post)	Capital	Land	Total
Maize, small and emergent farmers	5.7	9.1	0.0	0.0	0.6	37.7	3.5
Maize, commercial farmers	2.5	0.6	0.0	0.0	0.6	6.1	0.7
Drought-tolerant staples	3.6	1.8	0.0	0.0	0.1	18.2	1.0
Groundnuts	2.0	0.6	0.0	0.0	0.1	5.9	0.4
Sugar	0.8	0.2	0.0	0.0	0.3	1.9	0.3
Cotton	3.3	0.4	0.0	0.0	0.2	3.9	0.5
Tobacco	2.0	0.2	0.0	0.0	0.1	2.0	0.3
Coffee	0.2	0.6	0.0	0.0	0.1	6.5	0.3
Wheat	1.0	0.9	0.0	0.0	0.3	9.1	0.6
Horticulture crops	2.4	18.3	0.0	0.0	0.7	3.1	5.1
Other crops	0.4	11.8	1.1	0.0	0.1	5.8	3.3
Livestock products	1.5	0.0	7.6	0.0	1.1	0.0	1.8
Fisheries	1.8	1.0	0.3	0.0	1.1	0.0	0.9
Forestry	0.5	8.5	0.6	0.1	3.4	0.0	3.9
Metal mining	1.2	1.6	10.1	9.5	31.3	0.0	17.3
Food, beverages and tobacco	17.9	8.8	1.7	2.2	5.3	0.0	6.2
Textiles and garments	0.0	0.6	1.9	0.8	1.6	0.0	1.2
Wood, furniture and paper	2.8	0.7	2.4	1.7	2.9	0.0	2.2
Fertilizer, pesticides and basic chemicals	0.0	0.2	0.5	0.5	0.5	0.0	0.4
Other manufactures	0.2	0.1	0.5	1.2	2.5	0.0	1.3
Energy	0.0	0.3	1.4	2.5	9.2	0.0	4.7
Capital goods	0.2	0.7	2.9	3.0	1.3	0.0	1.4
Construction	0.6	1.1	2.4	1.4	1.9	0.0	1.7
Trade and transportation services	37.6	20.2	24.6	15.5	18.3	0.0	20.6
Tourism	0.6	1.2	2.7	2.2	0.7	0.0	1.1
Other market services	1.9	1.8	13.4	10.9	1.3	0.0	3.7
Finance	6.3	5.6	6.2	5.2	11.0	0.0	8.2
Public non-market services	3.0	3.2	19.9	43.1	3.5	0.0	7.3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 4: Household Incomes Across Factors

Factor Category	Share of Household Income from Each Factor Type				
	Metropolitan high income	Metropolitan low income	Other urban	Rural	All Households
Labor (Unskilled)	0.5	3.5	6.3	12.3	7.2
Labor (Primary)	5.0	26.2	23.4	39.5	27.9
Labor (Secondary)	14.4	31.7	10.6	12.0	17.6
Labor (Post)	8.0	4.7	1.3	1.8	3.8
Capital (Agriculture)	0.0	0.0	0.0	10.0	4.7
Capital (Mining Resource)	16.2	7.6	13.1	4.6	8.3
Capital (Other)	56.0	26.3	45.3	15.8	28.8
Land	0.0	0.0	0.0	3.9	1.8
Total	**100**	**100**	**100**	**100**	**100**

Table 5: Factor Incomes Across Households

Factor Category	Share of Factor Income by Each Household Group				
	Metropolitan high income	Metropolitan low income	Other urban	Rural	Total
Labor (Unskilled)	1.3	13.0	6.0	79.7	**100**
Labor (Primary)	3.6	24.8	5.7	65.9	**100**
Labor (Secondary)	16.6	47.5	4.1	31.8	**100**
Labor (Post)	42.7	32.6	2.3	22.5	**100**
Capital (Agriculture)	0.0	0.0	0.0	100.0	**100**
Capital (Mining Resource)	39.5	24.2	10.7	25.6	**100**
Capital (Other)	39.5	24.2	10.7	25.6	**100**
Land	0.0	0.0	0.0	100.0	**100**
All Factors	20.3	26.4	6.8	46.5	**100**

Table 6: Disaggregation of the Zambia SAM and CGE Model

Activities	Commodities	Factors
Maize (small and emergent farmers)	Maize	Unskilled labor
Maize (commercial farmers)	Drought-tolerant staples	Labor with primary education
Drought-tolerant staples	Groundnuts	Labor with secondary education
Groundnuts	Sugar	Labor with post secondary education and degree
Sugar	Cotton	Agricultural capital
Cotton	Tobacco	Mining resource capital
Tobacco	Coffee	Other capital
Coffee	Wheat	Land
Wheat	Horticulture crops	
Horticulture crops	Other crops	
Other crops	Livestock products	**Households**
Livestock products	Fisheries	Metropolitan high income
Fisheries	Forestry	Metropolitan low income
Forestry	Metal mining	Other urban
Metal mining	Food beverages and tobacco	Rural
Food beverages and tobacco	Textiles and garments	
Textiles and garments	Wood furniture and paper	
Wood furniture and paper	Fertilizer pesticides and basic chemicals	
Fertilizer pesticides and basic chemicals	Other manufactures	
Other manufactures	Energy	
Energy	Capital goods	
Capital goods	Construction	
Construction	Trade and transportation services	
Trade and transportation services	Tourism	
Tourism	Other market services	
Other market services	Finance	
Finance	Public non-market services	
Public non-market services		

Table 7: Sectoral Breakdown of Activities

	Aggregate Sector	Sector Components
1	Maize, small and emergent	Small and emergent production technology
2	Maize, commercial	Commercial production technology
3	Drought-tolerant staples	Cassava Millet Sorghum
4	Groundnuts	Groundnuts
5	Sugar	Sugar
6	Cotton	Cotton
7	Tobacco	Tobacco
8	Coffee	Coffee
9	Wheat	Wheat
10	Horticulture crops	Flowers Vegetables Fruits (Others)
11	Other crops	Soybeans Potatoes Rice Sunflowers (Others)
12	Livestock products	Cattle Goats Pigs Poultry (Others)
13	Fisheries	Fishing
14	Forestry	Forestry
15	Metal mining	Mineral ore mining Other minerals
16	Food, beverages, and tobacco	Food manufacturing Animal feed manufacturing Beverage manufacturing Tobacco manufacturing
17	Textiles and garments	Textiles manufacturing Wearing apparel manufacturing Leather products (except shoes) Footwear
18	Wood, furniture, and paper	Wood manufacturing Furniture and fixtures Paper products Printing and stationary

Table 7 (continued): Sectoral Breakdown of Activities

19	Fertilizer, pesticides, basic chem.	Industrial chemicals (2)
21	Other manufactures	Other chemical products Manufacture of petroleum products (1) Manufacture of coal products Manufacture of rubber products Manufacture of plastic products Manufacture of glass products Manufacture of lime and cement Manufacture of basic metal products Manufacture of non-ferrous metal products
22	Energy	Electricity generation Water supply Gas
23	Capital goods	Manufacturing of industrial engines and parts Manufacturing of electrical machines Manufacturing of transport equipment
24	Construction	Construction
25	Trade and transportation services	Wholesale trade Retail trade Rail transport Road transport Other transport (including transport services) Post and telecommunications
26	Tourism	Bars and restaurants Hotels and lodging
27	Other market services	Private community, social and personal services
28	Finance	Financial institutions Insurance services Real estate Business services
29	Public non-market services	Public administration Education Health Recreation and cultural services

Table 8: Elasticity Values for the Zambian Model

Commodity	Domestic and Imported Goods	Domestic and Exported Goods	Activity	Factors of Production
Maize	3	2.5	Maize (small and emergent farmers)	0.75
Drought-tolerant staples	3	2.5	Maize (commercial farmers)	0.75
Groundnuts	3	2.5	Drought-tolerant staples	0.75
Sugar	3	2.5	Groundnuts	0.75
Cotton	3	2.5	Sugar	0.75
Tobacco	3	4	Cotton	0.75
Coffee	3	2.5	Tobacco	0.75
Wheat	3	2.5	Coffee	0.75
Horticulture crops	3	2.5	Wheat	0.75
Other crops	3	2.5	Horticulture crops	0.75
Livestock products	3	2.5	Other crops	0.75
Fisheries	3	2.5	Livestock products	0.75
Forestry	3	2.5	Fisheries	0.75
Metal mining	3	2.5	Forestry	0.75
Food beverages and tobacco	1.25	4	Metal mining	0.15
Textiles and garments	0.5	4	Food beverages and tobacco	1.5
Wood furniture and paper	0.5	4	Textiles and garments	0.5
Fertilizer pesticides and basic chemicals	0.5	4	Wood furniture and paper	0.5
Other manufactures	0.5	4	Fertilizer pesticides and basic chemicals	0.5
Energy	0.5	4	Other manufactures	0.5
Capital goods	1.25	4	Energy	0.5
Construction	1.24	4	Capital goods	1.5
Trade and transportation services	0.5	1	Construction	1.5
Tourism	0.5	4	Trade and transportation services	0.9
Other market services	0.5	1	Tourism	0.5
Finance	0.5	1	Other market services	1.5
			Finance	1.5
			Public non-market services	1.5

Source: Hausner (2002).

Table 9: Short and Long-run Results from a 20 Percent Drop in World Copper Prices

	Base Year Value	Short-run Scenario	Long-run Scenario
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**	
Absorption	3144	-4.2	-3.8
Exports	1082	4.1	3.6
Imports	1228	-5.6	-4.9
Real GDP (market prices)	2998	-0.7	-0.6
Real Exchange Rate Index		**Percentage Change from Base**	
LCU per FCU	1	10.0	7.0
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**	
Metropolitan high income	298.3	-7.0	-6.4
Metropolitan low income	605.6	-4.9	-3.5
Other urban	88.1	-4.3	-4.8
Rural	755.2	-3.4	-2.9
Total	1747.2	-4.6	-3.8
Factor Income Distribution[1] (%)		**Deviation from Base**	
Unskilled labor	6.5	0.5	0.3
Primary labor	25.1	0.8	1.0
Secondary labor	15.9	-0.5	0.5
Post secondary labor	3.4	-0.1	0.1
Agricultural capital	4.2	0.1	0.2
Mining resource capital	11.9	-2.5	-4.0
Other capital	31.4	1.5	1.8
Land	1.7	0.3	0.1
Total	100.0		

[1] For a more detailed description of the factor categories see Section III and Table 6.

Table 10: Changes in Quantities Imported and Exported Following a 20 Percent Drop in World Copper Prices

| | Base Year Value (1995 bil. KwZ) | | Percentage Change from Base Year Value | | | |
| | | | Short-run | | Long-run | |
	Imports	Exports	Imports	Exports	Imports	Exports
Maize	30.6	6.2	-12.8	33.1	-12.7	31.3
Drought-tolerant staples	0.0	0.1	-18.8	30.3	-18.8	24.2
Groundnuts	0.2	0.4	-20.5	33.4	-18.7	25.6
Cotton	8.9	1.2	-1.4	17.3	-6.9	40.0
Tobacco	1.5	3.7	-1.9	10.4	-11.6	33.0
Coffee	0.0	2.7	-28.6	30.6	-35.7	43.5
Wheat	7.5	0.0	-10.4	22.9	-13.9	28.6
Horticulture crops	5.5	4.1	-29.0	46.0	-21.9	29.9
Other crops	5.8	3.0	-29.0	51.8	-21.7	33.3
Livestock products	1.1	1.1	-31.3	63.7	-20.3	32.7
Fisheries	0.1	0.1	-20.3	28.1	-14.1	15.8
Forestry	0.0	0.1	-31.3	51.4	-20.8	28.6
Metal mining	8.0	681.4	-25.0	-1.0	-20.6	-2.7
Food beverages and tobacco	53.7	15.4	-13.9	71.0	-10.5	41.9
Textiles and garments	33.5	16.5	-4.2	39.7	-3.8	49.8
Wood furniture and paper	71.4	1.8	-3.6	54.5	-2.9	49.0
Fertilizer pesticides and basic chemicals	44.4	1.0	0.4	14.2	0.7	69.3
Other manufactures	235.1	23.5	-2.9	20.2	-3.1	45.6
Energy	0.5	56.3	-0.6	2.2	1.0	-0.4
Capital goods	369.6	9.6	-6.2	37.5	-5.6	62.1
Trade and transportation services	99.4		-5.6		-3.7	
Tourism		31.4		5.0		15.5
Finance	191.6	22.4	-4.3	9.5	-3.8	9.1
Total	1168.4	881.9	-5.6	3.8	-4.9	3.2

Table 11: Results from a 20 Percent Reduction in World Copper Prices with a Compensating Increase in Foreign Borrowing

	Base Year Value	Increase in Foreign Borrowing (Percentage of Base Year Export Value)				
		0%	5%	10%	15%	20%
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**				
Absorption	3144	-4.2	-2.2	-0.2	1.7	3.6
Exports	1082	4.1	1.6	-0.7	-3.0	-5.1
Imports	1228	-5.6	-3.3	-0.9	1.6	4.2
Real GDP (market prices)	2998	-0.7	-0.4	-0.1	0.1	0.2
Real Exchange Rate Index		**Percentage Change from Base**				
LCU per FCU	1	10	6	2	-2	-7
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**				
Metropolitan high income	298.3	-7.0	-5.1	-3.3	-1.5	0.3
Metropolitan low income	605.6	-4.9	-2.8	-0.8	1.1	2.9
Other urban	88.1	-4.3	-3.1	-1.9	-0.8	0.4
Rural	755.2	-3.4	-1.1	1.1	3.3	5.5
Total	1747.2	-4.6	-2.5	-0.4	1.5	3.5
Shares of GDP (%)		**Deviation from Base**				
Trade Deficit	25.1	4.4	5.9	7.3	8.5	9.5
Current Account Balance	13.3	2.3	3.7	4.9	5.9	6.8
Factor Income Distribution[1] (%)		**Deviation from Base**				
Unskilled labor	6.5	0.5	0.5	0.4	0.4	0.3
Primary labor	25.1	0.8	1.3	1.7	2.2	2.6
Secondary labor	15.9	-0.5	-0.1	0.3	0.6	0.8
Post secondary labor	3.4	-0.1	0.0	0.1	0.2	0.2
Agricultural capital	4.2	0.1	0.2	0.3	0.5	0.6
Mining resource capital	11.9	-2.5	-3.4	-4.2	-5.0	-5.8
Other capital	31.4	1.5	1.3	1.2	1.1	1.2
Land	1.7	0.3	0.2	0.2	0.1	0.1
Total	100.0					

[1] For a more detailed description of the factor categories see Section III and Table 6.

Table 12: Short and Long-run Results from a 75 Percent Drop in Mining Sector Output

	Base Year Value	Short-run Scenario	Long-run Scenario
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**	
Absorption	3144	-11.7	-7.6
Exports	1082	-33.9	-27.4
Imports	1228	-21.7	-15.1
Real GDP (market prices)	2998	-15.6	-11.6
Real Exchange Rate Index		**Percentage Change from Base**	
LCU per FCU	1	42.1	25.3
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**	
Metropolitan high income	298.3	-19.8	-13.7
Metropolitan low income	605.6	-20.1	-8.3
Other urban	88.1	-11.4	-9.2
Rural	755.2	-5.8	-4.1
Total	1747.2	-13.4	-7.5
Factor Income Distribution[1] (%)		**Deviation from Base**	
Unskilled labor	6.5	1.6	0.6
Primary labor	25.1	2.7	2.2
Secondary labor	15.9	-7.2	-0.5
Post secondary labor	3.4	-1.5	-0.1
Agricultural capital	4.2	1.7	0.9
Mining resource capital	11.9	-2.2	-5.8
Other capital	31.4	3.0	2.1
Land	1.7	1.9	0.7
Total	100.0		

1. For a more detailed description of the factor categories see Section III and Table 6.

Table 13: Changes in Quantities Imported and Exported Following a 75 Percent Drop in Mining Sector Output

| | Base Year Value (1995 bil. KwZ) | | Percentage Change from Base Year Value | | | |
| | | | Short-run | | Long-run | |
	Imports	Exports	Imports	Exports	Imports	Exports
Maize	30.6	6.2	-31.6	135.9	-30.6	121.0
Drought-tolerant staples	0.0	0.1	-34.4	101.5	-34.4	81.8
Groundnuts	0.2	0.4	-37.3	114.5	-37.3	94.3
Cotton	8.9	1.2	4.2	51.1	11.9	245.5
Tobacco	1.5	3.7	15.1	19.1	-20.5	116.0
Coffee	0.0	2.7	-35.7	67.4	-64.3	210.0
Wheat	7.5	0.0	-8.6	48.6	-25.8	88.6
Horticulture crops	5.5	4.1	-69.4	269.7	-50.6	121.8
Other crops	5.8	3.0	-71.0	353.9	-51.0	143.6
Livestock products	1.1	1.1	-75.5	579.5	-49.5	159.3
Fisheries	0.1	0.1	-50.0	136.8	-32.8	68.4
Forestry	0.0	0.1	-77.1	282.9	-50.0	77.1
Metal mining	8.0	681.4	6.8	-75.2	25.6	-76.6
Food, beverages and tobacco	53.7	15.4	-37.8	429.5	-26.2	223.4
Textiles and garments	33.5	16.5	-11.8	142.5	-6.0	409.7
Wood, furniture and paper	71.4	1.8	-13.3	322.8	-6.4	309.6
Fertilizer, pesticides and basic chemicals	44.4	1.0	-4.9	87.0	-1.2	720.1
Other manufactures	235.1	23.5	-17.9	110.0	-14.2	128.5
Energy	0.5	56.3	-10.9	23.4	2.0	1.1
Capital goods	369.6	9.6	-25.3	170.9	-18.9	617.4
Trade and transportation services	99.4		-31.0		-16.0	
Tourism		31.4		13.5		48.7
Finance	191.6	22.4	-19.4	48.6	-12.9	36.5
Total	1168.4	881.9	-22.1	-34.6	-15.4	-29.7

Table 14: Results from a 75 Percent Drop in Mining Sector Output with a Compensating Increase in Foreign Borrowing

	Base Year Value	Increase in Foreign Borrowing (Percentage of Base Year Export Value)				
		0%	20%	40%	50%	60%
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**				
Absorption	3144	-11.7	-2.6	5.6	9.3	12.7
Exports	1082	-33.9	-44.6	-53.7	-57.5	-60.8
Imports	1228	-21.7	-14.2	-5.4	-0.6	4.5
Real GDP (market prices)	2998	-15.6	-13.0	-11.3	-10.8	-10.4
Real Exchange Rate Index		**Percentage Change from Base**				
LCU per FCU	1	42.1	27.1	10.4	1.5	-7.6
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**				
Metropolitan high income	298.3	-19.8	-10.2	-1.5	3.0	8.1
Metropolitan low income	605.6	-20.1	-10.3	-1.9	1.7	5.0
Other urban	88.1	-11.4	-3.7	2.3	5.2	8.5
Rural	755.2	-5.8	3.9	13.0	17.4	21.7
Total	1747.2	-13.4	-10.9	-8.5	-6.1	-3.8
Shares of GDP (%)		**Deviation from Base**				
Trade Deficit	25.1	7.3	14.6	18.4	18.8	18.4
Current Account Balance	13.3	9.0	16.6	20.5	21.0	20.8
Factor Income Distribution[1] (%)		**Deviation from Base**				
Unskilled labor	6.5	0.5	1.6	1.3	0.9	0.7
Primary labor	25.1	0.8	2.7	3.8	4.9	5.2
Secondary labor	15.9	-0.5	-7.2	-5.4	-4.0	-3.5
Post secondary labor	3.4	-0.1	-1.5	-0.9	-0.4	-0.3
Agricultural capital	4.2	0.1	1.7	2.0	2.5	2.8
Mining resource capital	11.9	-2.5	-2.2	-4.0	-5.9	-6.8
Other capital	31.4	1.5	3.0	1.6	0.8	0.9
Land	1.7	0.3	1.9	1.5	1.1	0.9
Total	100.0					

1. For a more detailed description of the factor categories see Section III and Table 6.

Table 15: Short-run Results from a 20 Percent Drop in World Copper Prices with Targeted Investment

	Base Year Value	Increase in Capital Stock of Targeted Sectors (Percentage of Base Year Capital Stock Value)				
		0%	5%	10%	15%	20%
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**				
Absorption	3144	-4.3	-3.9	-3.7	-3.4	-3.1
Exports	1082	4.1	4.6	5.2	5.7	6.2
Imports	1228	-5.6	-5.0	-4.5	-4.0	-3.5
Real GDP (market prices)	2998	-0.7	-0.4	-0.1	0.2	0.4
Real Exchange Rate Index		**Percentage Change from Base**				
LCU per FCU	1	10.0	9.2	8.4	7.6	6.8
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**				
Metropolitan high income	298.3	-7	-6.7	-6.4	-6.1	-5.8
Metropolitan low income	605.6	-4.9	-4.4	-4.0	-3.6	-3.2
Other urban	88.1	-4.3	-4.3	-4.2	-4.2	-4.1
Rural	755.2	-3.4	-3.1	-2.8	-2.5	-2.3
Total	1747.2	-4.6	-4.2	-3.9	-3.6	-3.3
Factor Income Distribution[1] (%)		**Deviation from Base**				
Unskilled labor	6.5	0.5	0.5	0.5	0.5	0.4
Primary labor	25.1	0.8	0.9	0.9	0.9	1.0
Secondary labor	15.9	-0.5	-0.3	-0.1	0.1	0.2
Post secondary labor	3.4	-0.1	-0.1	0.0	0.0	0.0
Agricultural capital	4.2	0.1	0.1	0.1	0.1	0.1
Mining resource capital	11.9	-2.5	-2.7	-2.9	-3.1	-3.3
Other capital	31.4	1.5	1.4	1.4	1.4	1.4
Land	1.7	0.3	0.3	0.2	0.2	0.2
Total	100.0					

1. For a more detailed description of the factor categories see Section III and Table 6.

Table 16: Short-run Changes in Quantities Imported and Exported Following a 20 Percent Drop in World Copper Prices and Targeted Investment

	Percentage Change from Base Year Value					
	Imports			Exports		
	Base Year Value (1995 bil. KwZ)	0% of current capital stock	20% of current capital stock	Base Year Value (1995 bil. KwZ)	0% of current capital stock	20% of current capital stock
Maize	30.6	-12.8	-8.8	6.2	33.1	20.5
Drought-tolerant staples	0.0	-20.8	-14.1	0.1	31.0	18.4
Groundnuts	0.2	-20.9	-14.5	0.4	33.4	20.4
Cotton	8.9	-1.4	-1.2	1.2	17.4	12.3
Tobacco	1.5	-1.9	-16.2	3.7	10.4	53.0
Coffee	0.0	-24.0	-16.7	2.7	30.7	18.8
Wheat	7.5	-10.4	-7.9	0.0	22.5	15.4
Horticulture crops	5.5	-29.0	-20.0	4.1	46.0	27.0
Other crops	5.8	-29.0	-19.2	3.0	51.8	28.8
Livestock products	1.1	-31.4	-21.3	1.1	63.7	35.7
Fisheries	0.1	-20.0	-13.9	0.1	28.1	17.4
Forestry	0.0	-31.4	-22.3	0.1	53.0	32.1
Metal mining	8.0	-25.0	-22.1	681.4	-1.0	-1.4
Food beverages and tobacco	53.7	-13.9	-9.8	15.4	71.0	43.2
Textiles and garments	33.5	-4.2	-3.1	16.5	39.7	28.4
Wood furniture and paper	71.4	-3.6	-2.6	1.8	54.5	34.2
Fertilizer pesticides and basic chemicals	44.4	0.4	0.9	1.0	14.2	5.8
Other manufactures	235.1	-2.9	-1.1	23.5	20.2	10.4
Energy	0.5	-0.7	-6.0	56.3	2.2	68.0
Capital goods	369.6	-6.2	-3.8	9.6	37.5	21.9
Trade and transportation services	99.4	-5.6	-3.4			
Tourism				31.4	5.0	26.1
Finance	191.6	-4.3	-2.5	22.4	9.5	5.6
Total	1168.4	-5.7	-3.6	881.9	3.8	6.9

Table 17: Long-run Results from a 20 Percent Drop in World Copper Prices with Targeted Investment

	Base Year Value	Increase in Capital Stock of Targeted Sectors (Percentage of Base Year Capital Stock Value)				
		0%	5%	10%	15%	20%
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**				
Absorption	3144	-3.8	-3.5	-3.2	-2.9	-2.6
Exports	1082	3.6	4.1	4.7	5.2	5.7
Imports	1228	-4.9	-4.4	-3.9	-3.4	-2.9
Real GDP (market prices)	2998	-0.6	-0.3	0.0	0.2	0.5
Real Exchange Rate Index		**Percentage Change from Base**				
LCU per FCU	1	7.4	7.0	6.5	6.0	5.4
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**				
Metropolitan high income	298.3	-6.4	-6.1	-5.8	-5.5	-5.2
Metropolitan low income	605.6	-3.5	-3.2	-2.9	-2.6	-2.3
Other urban	88.1	-4.8	-4.6	-4.5	-4.3	-4.1
Rural	755.2	-2.9	-2.6	-2.2	-1.9	-1.6
Total	1747.2	-3.8	-3.5	-3.2	-2.9	-2.6
Factor Income Distribution[1] (%)		**Deviation from Base**				
Unskilled labor	6.5	0.3	0.3	0.3	0.3	0.3
Primary labor	25.1	1.0	1.1	1.1	1.2	1.2
Secondary labor	15.9	0.5	0.5	0.6	0.6	0.7
Post secondary labor	3.4	0.1	0.1	0.1	0.1	0.1
Agricultural capital	4.2	0.2	0.2	0.2	0.2	0.2
Mining resource capital	11.9	-4.0	-4.2	-4.4	-4.5	-4.7
Other capital	31.4	1.8	1.9	1.9	2.0	2.0
Land	1.7	0.1	0.1	0.1	0.1	0.1
Total	100.0					

1. For a more detailed description of the factor categories see Section III and Table 6.

Table 18: Long-run Changes in Quantities Imported and Exported Following a 20 Percent Drop in World Copper Prices and Targeted Investment

	Percentage Change from Base Year Value					
	Imports			Exports		
	Base Year Value (1995 bil. KwZ)	0% of current capital stock	20% of current capital stock	Base Year Value (1995 bil. KwZ)	0% of current capital stock	20% of current capital stock
Maize	30.6	-12.6	-9.3	6.2	31.3	22.0
Drought-tolerant staples	0.0	-18.5	-12.2	0.1	23.6	14.0
Groundnuts	0.2	-18.7	-12.3	0.4	25.7	15.4
Cotton	8.9	-6.9	-4.4	1.2	40.1	29.2
Tobacco	1.5	-11.6	-16.4	3.7	33.0	49.9
Coffee	0.0	-31.0	-20.0	2.7	43.5	23.4
Wheat	7.5	-13.9	-10.0	0.0	27.4	18.4
Horticulture crops	5.5	-21.9	-14.1	4.1	29.9	16.8
Other crops	5.8	-21.7	-13.5	3.0	33.3	17.9
Livestock products	1.1	-20.4	-13.1	1.1	32.7	18.7
Fisheries	0.1	-14.5	-9.8	0.1	16.3	10.3
Forestry	0.0	-20.4	-12.7	0.1	29.3	16.4
Metal mining	8.0	-20.6	-17.7	681.4	-2.7	-3.3
Food beverages and tobacco	53.7	-10.5	-7.1	15.4	41.9	25.6
Textiles and garments	33.5	-3.8	-2.7	16.5	49.8	40.5
Wood furniture and paper	71.4	-2.9	-1.5	1.8	49.0	28.9
Fertilizer pesticides and basic chemicals	44.4	0.7	1.3	1.0	69.3	42.7
Other manufactures	235.1	-3.1	-1.4	23.5	45.6	44.3
Energy	0.5	1.1	-3.8	56.3	-0.4	63.2
Capital goods	369.6	-5.6	-3.3	9.6	62.1	34.0
Trade and transportation services	99.4	-3.7	-2.1			
Tourism				31.4	15.5	32.3
Finance	191.6	-3.8	-2.0	22.4	9.1	6.0
Total	1168.4	-5.0	-3.0	881.9	3.2	6.3

Table 19: Short-run Results from a 75 Percent Drop in Copper Mining Output with Targeted Investment

	Base Year Value	Increase in Capital Stock of Targeted Sectors (Percentage of Base Year Capital Stock Value)				
		0%	5%	10%	15%	20%
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**				
Absorption	3144	-11.7	-11.3	-11.0	-10.6	-10.3
Exports	1082	-33.9	-33.4	-32.9	-32.4	-31.9
Imports	1228	-21.7	-21.3	-20.8	-20.4	-20.0
Real GDP (market prices)	2998	-15.6	-15.2	-14.8	-14.5	-14.1
Real Exchange Rate Index		**Percentage Change from Base**				
LCU per FCU	1	42.1	41.5	40.9	40.3	39.7
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**				
Metropolitan high income	298.3	-19.8	-19.2	-18.7	-18.1	-17.5
Metropolitan low income	605.6	-20.1	-19.5	-19	-18.6	-18.1
Other urban	88.1	-11.4	-11.1	-10.7	-10.4	-10.1
Rural	755.2	-5.8	-5.6	-5.3	-5.1	-4.8
Total	1747.2	-13.4	-13.0	-12.6	-12.2	-11.9
Factor Income Distribution[1] (%)		**Deviation from Base**				
Unskilled labor	6.5	1.6	1.5	1.5	1.5	1.4
Primary labor	25.1	2.7	2.6	2.6	2.6	2.5
Secondary labor	15.9	-7.2	-7	-6.9	-6.7	-6.5
Post secondary labor	3.4	-1.5	-1.5	-1.4	-1.4	-1.3
Agricultural capital	4.2	1.7	1.7	1.7	1.6	1.6
Mining resource capital	11.9	-2.2	-2.3	-2.4	-2.6	-2.7
Other capital	31.4	3.0	3.0	3.1	3.2	3.2
Land	1.7	1.9	1.9	1.9	1.8	1.8
Total	100.0					

[1] For a more detailed description of the factor categories see Section III and Table 6.

Table 20: Short-run Changes in Quantities Imported and Exported Following a 75 Percent Drop in Copper Mining Output and Targeted Investment

| | Percentage Change from Base Year Value | | | | | |
| | Imports | | | Exports | | |
	Base Year Value (1995 bil. KwZ)	0% of current capital stock	20% of current capital stock	Base Year Value (1995 bil. KwZ)	0% of current capital stock	20% of current capital stock
Maize	30.6	-31.7	-29.3	6.2	135.9	122.8
Drought-tolerant staples	0.0	-36.4	-33.4	0.1	101.6	90.8
Groundnuts	0.2	-37.6	-35.1	0.4	114.5	103.8
Cotton	8.9	4.2	4.0	1.2	51.1	49.2
Tobacco	1.5	15.1	-3.1	3.7	19.1	68.6
Coffee	0.0	-36.1	-34.0	2.7	67.5	62.0
Wheat	7.5	-8.6	-8.1	0.0	49.4	46.4
Horticulture crops	5.5	-69.4	-65.9	4.1	269.7	236.5
Other crops	5.8	-71.0	-67.2	3.0	353.9	301.4
Livestock products	1.1	-75.4	-72.7	1.1	579.6	503.9
Fisheries	0.1	-49.4	-47.0	0.1	137.5	125.9
Forestry	0.0	-76.4	-73.7	0.1	284.9	246.2
Metal mining	8.0	6.8	8.3	681.4	-75.2	-75.2
Food beverages and tobacco	53.7	-37.8	-35.1	15.4	429.5	383.6
Textiles and garments	33.5	-11.8	-10.8	16.5	142.5	134.8
Wood furniture and paper	71.4	-13.3	-12.5	1.8	322.9	294.7
Fertilizer pesticides and basic chemicals	44.4	-4.9	-4.4	1.0	87.0	80.6
Other manufactures	235.1	-17.9	-16.1	23.5	110.0	100.2
Energy	0.5	-10.9	-14.9	56.3	23.4	88.4
Capital goods	369.6	-25.3	-23.3	9.6	170.9	157.0
Trade and transportation services	99.4	-31.0	-29.8			
Tourism				31.4	13.5	37.5
Finance	191.6	-19.4	-18.0	22.4	48.7	44.4
Total	1168.4	-21.7	-20.1	881.9	-34.6	-31.5

Table 21: Long-run Results from a 75 Percent Drop in Copper Mining Output with Targeted Investment

	Base Year Value	Increase in Capital Stock of Targeted Sectors (Percentage of Base Year Capital Stock Value)				
		0%	5%	10%	15%	20%
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**				
Absorption	3144	-7.6	-7.3	-6.9	-6.7	-6.4
Exports	1082	-27.4	-26.9	-26.4	-26.0	-25.5
Imports	1228	-15.1	-14.7	-14.4	-14.0	-13.6
Real GDP (market prices)	2998	-11.6	-11.3	-11.0	-10.6	-10.3
Real Exchange Rate Index		**Percentage Change from Base**				
LCU per FCU	1	25.3	25.1	24.8	24.5	24.1
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**				
Metropolitan high income	298.3	-13.7	-13.4	-13	-12.6	-12.2
Metropolitan low income	605.6	-8.3	-8	-7.7	-7.4	-7.1
Other urban	88.1	-9.2	-8.9	-8.7	-8.4	-8.1
Rural	755.2	-4.1	-3.8	-3.4	-3.1	-2.8
Total	1747.2	-7.5	-7.1	-6.8	-6.5	-6.2
Factor Income Distribution[1] (%)		**Deviation from Base**				
Unskilled labor	6.5	0.6	0.6	0.7	0.7	0.6
Primary labor	25.1	2.2	2.2	2.2	2.2	2.1
Secondary labor	15.9	-0.5	-0.5	-0.5	-0.4	-0.4
Post secondary labor	3.4	-0.1	-0.1	-0.1	-0.1	-0.1
Agricultural capital	4.2	0.9	0.9	0.9	0.9	0.9
Mining resource capital	11.9	-5.8	-5.9	-6.0	-6.0	-6.1
Other capital	31.4	2.1	2.2	2.2	2.2	2.3
Land	1.7	0.7	0.7	0.7	0.6	0.6
Total	100.0					

[1]. For a more detailed description of the factor categories see Section III and Table 6.

Table 22: Changes in Quantities Imported and Exported Following a 75 Percent Drop in Copper Mining Output and Targeted Investment

	Percentage Change from Base Year Value					
	Imports			Exports		
	Base Year Value (1995 bil. KwZ)	0% of current capital stock	20% of current capital stock	Base Year Value (1995 bil. KwZ)	0% of current capital stock	20% of current capital stock
Maize	30.6	-30.6	-28.7	6.2	121.0	112.4
Drought-tolerant staples	0.0	-35.6	-32.3	0.1	81.1	72.5
Groundnuts	0.2	-37.6	-34.3	0.4	94.2	84.1
Cotton	8.9	11.9	15.4	1.2	245.6	237.2
Tobacco	1.5	-20.5	-26.4	3.7	116.0	155.9
Coffee	0.0	-64.1	-58.1	2.7	210.0	163.8
Wheat	7.5	-25.8	-23.7	0.0	90.1	83.2
Horticulture crops	5.5	-50.6	-46.5	4.1	121.8	105.8
Other crops	5.8	-51.0	-46.5	3.0	143.6	122.5
Livestock products	1.1	-49.5	-45.9	1.1	159.4	140.9
Fisheries	0.1	-33.6	-31.0	0.1	68.8	63.5
Forestry	0.0	-50.4	-46.7	0.1	78.4	65.8
Metal mining	8.0	25.6	30.6	681.4	-76.6	-76.7
Food beverages and tobacco	53.7	-26.2	-23.7	15.4	223.4	200.3
Textiles and garments	33.5	-6.0	-4.9	16.5	409.7	417.5
Wood furniture and paper	71.4	-6.4	-4.8	1.8	309.7	274.1
Fertilizer pesticides and basic chemicals	44.4	-1.2	-0.2	1.0	720.3	604.1
Other manufactures	235.1	-14.2	-12.7	23.5	128.5	142.0
Energy	0.5	2.1	-1.9	56.3	1.1	64.3
Capital goods	369.6	-18.9	-17.5	9.6	617.3	477.3
Trade and transportation services	99.4	-16.1	-15.2			
Tourism				31.4	48.7	74.7
Finance	191.6	-12.9	-11.6	22.4	36.5	34.3
Total	1168.4	-15.3	-13.8	881.9	-29.7	-26.7

Appendix: Sensitivity Analysis

In order to assess the robustness of our findings, we tested the sensitivity of the simulation results to changes in the trade elasticities (i.e., the substitution elasticities between import demand and demand for domestic output, and the transformation elasticities between export supply and supply to the domestic market). The simulations concerning the drop in the world price of copper and the collapse in copper mining output were rerun under both higher and lower trade elasticities and for both the short- and long-run scenarios. The base-scenario elasticities values (as shown in Table 8) were halved and then doubled, thereby reducing (increasing) the ease at which producers can shift between production for the domestic and foreign markets, and reducing (increasing) the willingness of consumers to shift between the consumption of domestic and foreign commodities.

Drop in the World Price of Copper

Tables A1 and A2 show the results of a 20 percent drop in world copper prices for the short-run scenario. Although the first table shows that there is an increased depreciation of the real exchange rate when trade elasticities are halved, the second table reveals that there is very little change in the quantity of imports and exports between the base scenario and those with adjusted elasticities. In the base-scenario the decrease in import quantity is 5.6 percent, while the increase in export quantity is 3.8 percent. However, in both the reduced- and increased-elasticities scenarios there is less than a 0.5 percent change in real import quantity growth, and less than 0.1 percent change in real export quantity growth. Furthermore, real GDP growth varies by 0.1 percent depending on the elasticity values. These small changes suggest that the aggregate results are robust to assumptions on elasticities.

This change at the aggregate level, however, does not highlight the somewhat larger changes that occur at the level of individual commodities. Table A2 indicates that an increase in the value of trade elasticities tends to favor the growth of the agricultural and agro-related exports commodities, while reducing the export growth experienced by other commodities. The converse is true for a reduction of trade elasticities: agricultural an agro-related industries are disfavoured, reducing the returns to the factors that are used more extensively in these sectors and dampening the redistributive effect of falling world copper prices. In the base-scenario it was found that the price shock was progressive in that rural households were relatively

better off than richer metropolitan households following the drop in world prices. However, the reduction in elasticity values reduces the shift towards agricultural exports and production, therefore reducing the relative returns of the factors used by agriculture (the returns of which are largely accrued by rural households). Alternatively, an increase in elasticity values improves the welfare of rural households relative to non-rural households. Therefore, while adjustments in trade elasticities do not significantly change the level of aggregate real household consumption, the results indicate that the redistributive effects of the price shock are slightly muted when elasticities are lowered.

The results for the long-run scenario (presented in Tables A3 and A4) arrive at similar conclusions. Again the drop in real GDP is small, but the currency is forced to depreciate further when trade elasticities are lowered (the depreciation is always smaller in the long-run scenarios since capital is more mobile across sectors). While this depreciation has little impact on the overall quantity of imports and exports, there is a similar shift in quantities for individual traded commodities when elasticities are changed. Adjusting substitution possibilities has similar impacts on factor returns as in the short-run scenario, and again this mutes the redistributive effects of the world price shock when elasticity values are reduced.

Collapse in Copper Mining Output

Tables A5 and A6 present the sensitivity analysis' short-run results for a complete drop in copper mining output. When the value of the trade elasticities are lower, the depreciation of the real exchange rate is substantially larger. This higher depreciation is necessitated by the lower willingness of suppliers to shift their production towards exports and demanders to shift their demand toward domestic output. Conversely, increasing the trade elasticities reduces the need to depreciate the real exchange rate. While this change in the exchange rate does slightly influence the magnitude of import and export growth, it is not alter the direction of change. Furthermore, there is little change in the effect of the collapse of mining output on real GDP following a change in the trade elasticity values.

In both the short run (Tables A5 and A6) and long run (Tables A7 and A8), there is some change in import and export quantities following adjusts to the trade elasticities. In the short-run scenario, horticultural and agro-related exports benefit from an increase in trade elasticities, while the remaining crop-sectors' export growth is reduced. While similar trends are experienced in the long-run sensitivity analysis, there is also a

further increase in export growth for the capital goods and other manufacturers commodities.

Summary

The results from the sensitivity analysis indicate that the conclusions reached by this report are robust to changes in the trade elasticities. While there is some movement in the magnitude of individual traded commodities, there is little variation in the macro aggregates between the reduced and increased elasticity scenarios. This is particularly true for the drop in world copper prices.

Adjusting the elasticity values does somewhat alter the redistributive effects of the world price and mining output scenarios, but the general conclusion, that rural households suffer less than richer metropolitan households, remains robust.

Finally, while the magnitude of import and export quantities are affected by changing the elasticity values, the impact of the two shocks still favours those traded commodities identified earlier in the report.

Table A1: Short-run Sensitivity Analysis for a 20 Percent Drop in World Copper Prices: Main Indicators

	Base Year Value	Lower Elasticities	Base Elasticities	Higher Elasticities
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**		
Absorption	3144	-5.0	-4.2	-4.1
Exports	1082	4.1	4.1	4.1
Imports	1228	-5.9	-5.6	-5.4
Real GDP (market prices)	2998	-0.8	-0.7	-0.6
Real Exchange Rate Index		**Percentage Change from Base**		
LCU per FCU	1	16.5	10.0	6.0
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**		
Metropolitan high income	298.3	-6.3	-7.0	-7.5
Metropolitan low income	605.6	-4.7	-4.9	-5.0
Other urban	88.1	-3.1	-4.3	-5.2
Rural	755.2	-3.6	-3.4	-3.2
Total	1747.2	-4.4	-4.6	-4.7
Factor Income Distribution[1] (%)		**Deviation from Base**		
Unskilled labor	6.5	0.6	0.5	0.5
Primary labor	25.1	0.2	0.8	1.3
Secondary labor	15.9	-0.7	-0.5	-0.3
Post secondary labor	3.4	-0.2	-0.1	-0.1
Agricultural capital	4.2	0.0	0.1	0.1
Mining resource capital	11.9	-1.3	-2.5	-3.3
Other capital	31.4	1.1	1.5	1.6
Land	1.7	0.2	0.3	0.2
Total	100.0			

[1]. For a more detailed description of the factor categories see Section III and Table 6.

Table A2: Short-run Sensitivity Analysis for a 20 Percent Fall in World Copper Prices: Imports and Exports

	Imports (Percentage Change from Base Year Value)			Exports (Percentage Change from Base Year Value)		
	Lower Elasticities	Base Elasticities	Higher Elasticities	Lower Elasticities	Base Elasticities	Higher Elasticities
Maize	-12.7	-12.8	-11.4	30.4	33.1	31.4
Drought-tolerant staples	-19.0	-18.8	-21.6	25.3	30.3	35.7
Groundnuts	-19.1	-20.5	-21.2	27.3	33.4	37.5
Cotton	-3.2	-1.4	0.4	19.7	17.3	14.1
Tobacco	-4.6	-1.9	1.1	13.2	10.4	7.6
Coffee	-25.6	-28.6	-19.3	32.6	30.6	24.2
Wheat	-11.5	-10.4	-7.7	22.5	22.9	19.1
Horticulture crops	-23.6	-29.0	-34.1	35.0	46.0	58.7
Other crops	-23.6	-29.0	-34.1	39.1	51.8	66.5
Livestock products	-23.9	-31.3	-40.8	42.2	63.7	98.6
Fisheries	-16.4	-20.3	-24.4	19.8	28.1	39.2
Forestry	-23.9	-31.3	-41.9	36.3	51.4	82.0
Metal mining	-15.7	-25.0	-41.9	-0.4	-1.0	-1.5
Food, beverages and tobacco	-11.6	-13.9	-16.4	50.1	71.0	97.8
Textiles and garments	-4.6	-4.2	-3.6	37.4	39.7	38.2
Wood, furniture and paper	-3.6	-3.6	-3.5	47.3	54.5	57.1
Fertilizer, pesticides and basic chemicals	0.4	0.4	0.3	18.5	14.2	10.0
Other manufactures	-3.5	-2.9	-2.4	21.9	20.2	18.1
Energy	-0.9	-0.6	-0.6	2.9	2.2	1.8
Capital goods	-7.5	-6.2	-5.1	39.8	37.5	32.1
Trade and transportation services	-4.9	-5.6	-6.3			
Tourism				6.3	5.0	3.8
Finance	-4.3	-4.3	-3.9	8.6	9.5	9.1
Total	-6.0	-5.6	-5.5	3.8	3.8	3.7

Table A3: Long-run Sensitivity Analysis for a 20 Percent Drop in World Copper Prices: Main Indicators

	Base Year Value	Lower Elasticities	Base Elasticities	Higher Elasticities
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**		
Absorption	3144	-4.7	-3.8	-3.4
Exports	1082	3.9	3.6	3.3
Imports	1228	-5.4	-4.9	-4.7
Real GDP (market prices)	2998	-0.9	-0.6	-0.5
Real Exchange Rate Index		**Percentage Change from Base**		
LCU per FCU	1	12.9	7.0	4.0
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**		
Metropolitan high income	298.3	-5.8	-6.4	-6.7
Metropolitan low income	605.6	-3.6	-3.5	-3.4
Other urban	88.1	-3.7	-4.8	-5.4
Rural	755.2	-3.6	-2.9	-2.5
Total	1747.2	-4.0	-3.8	-3.7
Factor Income Distribution[1] (%)		**Deviation from Base**		
Unskilled labor	6.5	0.2	0.3	0.4
Primary labor	25.1	0.6	1.0	1.3
Secondary labor	15.9	0.2	0.5	0.6
Post secondary labor	3.4	0.0	0.1	0.1
Agricultural capital	4.2	0.1	0.2	0.2
Mining resource capital	11.9	-2.7	-4.0	-4.9
Other capital	31.4	1.6	1.8	2.0
Land	1.7	0.1	0.1	0.1
Total	100.0			

[1] For a more detailed description of the factor categories see Section III and Table 6.

Table A4: Long-run Sensitivity Analysis for a 20 Percent Fall in World Copper Prices: Imports and Exports

	Imports (Percentage Change from Base Year Value)			Exports (Percentage Change from Base Year Value)		
	Lower Elasticities	Base Elasticities	Higher Elasticities	Lower Elasticities	Base Elasticities	Higher Elasticities
Maize	-11.7	-12.7	-12.7	26.6	31.3	33.0
Drought-tolerant staples	-17.5	-18.8	-17.9	20.4	24.2	23.6
Groundnuts	-17.4	-18.7	-18.4	21.9	25.6	26.4
Cotton	-7.0	-6.9	-6.4	33.6	40.0	42.8
Tobacco	-14.0	-11.6	-7.8	38.3	33.0	22.9
Coffee	-29.0	-35.7	-30.2	38.7	43.5	42.1
Wheat	-13.1	-13.9	-13.7	23.6	28.6	27.9
Horticulture crops	-19.2	-21.9	-23.1	25.4	29.9	32.2
Other crops	-19.1	-21.7	-22.9	28.0	33.3	36.0
Livestock products	-17.7	-20.3	-22.3	26.0	32.7	37.9
Fisheries	-12.9	-14.1	-15.5	12.6	15.8	19.0
Forestry	-18.2	-20.8	-21.5	24.2	28.6	32.2
Metal mining	-13.1	-20.6	-36.1	-1.5	-2.7	-3.8
Food, beverages and tobacco	-9.7	-10.5	-10.9	33.6	41.9	46.8
Textiles and garments	-4.0	-3.8	-3.6	39.9	49.8	55.7
Wood, furniture and paper	-3.3	-2.9	-2.5	38.7	49.0	55.6
Fertilizer, pesticides and basic chemicals	0.3	0.7	0.9	55.7	69.3	77.7
Other manufactures	-3.5	-3.1	-2.9	33.5	45.6	62.3
Energy	-0.4	1.0	2.5	2.9	-0.4	-3.5
Capital goods	-6.7	-5.6	-4.8	45.9	62.1	74.3
Trade and transportation services	-3.9	-3.7	-3.4			
Tourism				24.1	15.5	8.9
Finance	-4.0	-3.8	-3.5	6.9	9.1	10.5
Total	-5.5	-4.9	-4.8	3.7	3.2	2.8

Table A5: Short-run Sensitivity Analysis for a 75 Percent Drop in Copper Mining Output: Main Indicators

	Base Year Value	Lower Elasticities	Base Elasticities	Higher Elasticities
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**		
Absorption	3144	-14.4	-11.7	-10.2
Exports	1082	-37.1	-33.9	-31.3
Imports	1228	-24.5	-21.7	-19.6
Real GDP (market prices)	2998	-18.4	-15.6	-13.9
Real Exchange Rate Index		**Percentage Change from Base**		
LCU per FCU	1	76.8	42.1	23.7
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**		
Metropolitan high income	298.3	-19.9	-19.8	-19.9
Metropolitan low income	605.6	-21.8	-20.1	-19.0
Other urban	88.1	-8.0	-11.4	-13.3
Rural	755.2	-7.7	-5.8	-5.1
Total	1747.2	-14.7	-13.4	-12.9
Factor Income Distribution[1] (%)		**Deviation from Base**		
Unskilled labor	6.5	2.0	1.6	1.3
Primary labor	25.1	0.3	2.7	4.1
Secondary labor	15.9	-8.9	-7.2	-6.0
Post secondary labor	3.4	-1.9	-1.5	-1.3
Agricultural capital	4.2	1.8	1.7	1.8
Mining resource capital	11.9	2.9	-2.2	-4.5
Other capital	31.4	1.7	3.0	3.2
Land	1.7	2.3	1.9	1.5
Total	100.0			

[1] For a more detailed description of the factor categories see Section III and Table 6.

Table A6: Short-run Sensitivity Analysis for a 75 Percent in Mining Sector Output: Imports and Exports

	Imports (Percentage Change from Base Year Value)			Exports (Percentage Change from Base Year Value)		
	Lower Elasticities	Base Elasticities	Higher Elasticities	Lower Elasticities	Base Elasticities	Higher Elasticities
Maize	-36.4	-31.6	-22.3	143.0	135.9	119.6
Drought-tolerant staples	-43.6	-34.4	-22.4	98.3	101.5	91.2
Groundnuts	-44.9	-37.3	-22.6	111.8	114.5	101.5
Cotton	-1.3	4.2	10.5	57.0	51.1	51.2
Tobacco	0.4	15.1	31.1	26.4	19.1	15.5
Coffee	-49.4	-35.7	-18.0	93.9	67.4	39.4
Wheat	-22.6	-8.6	5.6	69.8	48.6	34.0
Horticulture crops	-66.0	-69.4	-69.8	218.2	269.7	327.6
Other crops	-67.3	-71.0	-72.6	281.3	353.9	458.9
Livestock products	-68.0	-75.5	-79.2	328.9	579.5	964.4
Fisheries	-44.7	-50.0	-54.3	90.2	136.8	200.3
Forestry	-69.9	-77.1	-83.8	173.6	282.9	557.3
Metal mining	23.2	6.8	-11.8	-75.3	-75.2	-75.3
Food, beverages and tobacco	-36.9	-37.8	-36.8	297.5	429.5	544.5
Textiles and garments	-15.3	-11.8	-7.3	140.7	142.5	139.2
Wood, furniture and paper	-14.8	-13.3	-11.9	294.3	322.8	337.2
Fertilizer, pesticides and basic chemicals	-4.2	-4.9	-5.7	91.5	87.0	79.7
Other manufactures	-21.0	-17.9	-15.4	110.0	110.0	107.6
Energy	-12.1	-10.9	-10.5	25.5	23.4	22.2
Capital goods	-31.4	-25.3	-20.9	187.2	170.9	148.5
Trade and transportation services	-28.5	-31.0	-36.8			
Tourism				15.9	13.5	11.2
Finance	-20.3	-19.4	-18.2	42.7	48.6	48.4
Total	-24.8	-22.1	-19.5	-37.5	-34.6	-32.4

Table A7: Long-run Sensitivity Analysis for a 75 Percent Drop in Copper Mining Output: Main Indicators

	Base Year Value	Lower Elasticities	Base Elasticities	Higher Elasticities
Real Gross Domestic Product (1995 bil. KwZ)		**Percentage Change from Base**		
Absorption	3144	-12.0	-7.6	-5.7
Exports	1082	-31.4	-27.4	-24.8
Imports	1228	-18.8	-15.1	-12.9
Real GDP (market prices)	2998	-14.9	-11.6	-9.7
Real Exchange Rate Index		**Percentage Change from Base**		
LCU per FCU	1	50.5	25.3	12.1
Real Household Consumption (1995 bil. KwZ)		**Percentage Change from Base**		
Metropolitan high income	298.3	-14.6	-13.7	-12.6
Metropolitan low income	605.6	-10.7	-8.3	-6.8
Other urban	88.1	-7.5	-9.2	-9.6
Rural	755.2	-6.8	-4.1	-2.8
Total	1747.2	-9.5	-7.5	-6.2
Factor Income Distribution[1] (%)		**Deviation from Base**		
Unskilled labor	6.5	0.3	0.6	0.8
Primary labor	25.1	1.0	2.2	2.7
Secondary labor	15.9	-1.9	-0.5	0.2
Post secondary labor	3.4	-0.4	-0.1	0.0
Agricultural capital	4.2	0.8	0.9	0.8
Mining resource capital	11.9	-2.4	-5.8	-7.4
Other capital	31.4	1.7	2.1	2.3
Land	1.7	0.9	0.7	0.5
Total	100.0			

[1] For a more detailed description of the factor categories see Section III and Table 6.

Table A8: Long-run Sensitivity Analysis for a 75 Percent Drop in Mining Sector Output: Imports and Exports

	Imports (Percentage Change from Base Year Value)			Exports (Percentage Change from Base Year Value)		
	Lower Elasticities	Base Elasticities	Higher Elasticities	Lower Elasticities	Base Elasticities	Higher Elasticities
Maize	-32.5	-30.6	-25.4	122.2	121.0	100.3
Drought-tolerant staples	-39.5	-34.4	-26.5	80.7	81.8	62.5
Groundnuts	-40.8	-37.3	-29.9	92.2	94.3	76.7
Cotton	7.7	11.9	19.6	238.8	245.5	217.6
Tobacco	-32.6	-20.5	-7.1	178.0	116.0	62.1
Coffee	-75.6	-64.3	-48.4	396.3	210.0	112.4
Wheat	-29.1	-25.8	-18.3	92.8	88.6	66.8
Horticulture crops	-51.3	-50.6	-46.3	122.5	121.8	107.4
Other crops	-51.6	-51.0	-47.0	142.8	143.6	128.6
Livestock products	-48.3	-49.5	-49.6	132.8	159.3	174.0
Fisheries	-32.6	-32.8	-33.2	55.1	68.4	73.8
Forestry	-53.1	-50.0	-44.2	73.6	77.1	67.9
Metal mining	26.1	25.6	24.4	-76.4	-76.6	-76.8
Food, beverages and tobacco	-27.0	-26.2	-24.9	186.6	223.4	231.7
Textiles and garments	-7.6	-6.0	-5.2	334.7	409.7	455.9
Wood, furniture and paper	-9.3	-6.4	-4.9	243.4	309.6	352.9
Fertilizer, pesticides and basic chemicals	-0.8	-1.2	-2.3	655.0	720.1	784.1
Other manufactures	-17.7	-14.2	-12.3	79.0	128.5	165.8
Energy	-4.0	2.0	5.7	14.4	1.1	-7.3
Capital goods	-24.8	-18.9	-15.6	418.8	617.4	798.3
Trade and transportation services	-19.1	-16.0	-14.2			
Tourism				82.3	48.7	26.1
Finance	-15.2	-12.9	-11.7	28.3	36.5	41.2
Total	-19.0	-15.4	-13.0	-32.6	-29.7	-27.8

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