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**DOES TRADE LIBERALIZATION ENHANCE INCOME  
GROWTH AND EQUITY IN ZIMBABWE?  
THE ROLE OF COMPLEMENTARY POLICIES**

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**September 1998**

*TMD Discussion Papers contain preliminary material and research results, and are circulated prior to a full peer review in order to stimulate discussion and critical comment. It is expected that most Discussion Papers will eventually be published in some other form, and that their content may also be revised. This paper was written under the IFPRI project Macroeconomic Reforms and Regional Integration in Southern Africa (MERRISA), which is funded by DANIDA (Denmark) and GTZ (Germany).*

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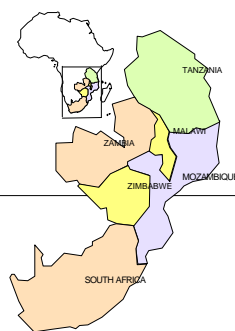
TMD Discussion Paper No. 32

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The Role of Complementary Policies**

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**ABSTRACT**

Using an agriculture-focused CGE model for Zimbabwe with 1991 as base period, this paper examines quantitatively the income and equity effects of trade liberalization in isolation and in conjunction with potentially complementary changes in fiscal and land policies. Trade policy reform alone (dismantling of import and foreign exchange controls, and reduction of import taxes to a low uniform rate) is shown to increase aggregate disposable household income significantly. However, the least income gain accrues to smallholder farm households, which account for about four-fifths of the poor in Zimbabwe, so the equity impact is unfavorable. Concurrent implementation with specific changes in government expenditure and tax policies and two alternative stylized land redistribution schemes yields differing outcomes in terms of aggregate household income growth and its distribution.

**Paper presented at the Zimbabwe Conference on Macroeconomic Policy, Management, and Performance since Independence, sponsored by the Department of Economics, University of Zimbabwe and the Professional Development and Training Programme in Harare on 19-21 August 1998.**

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## **1. Introduction**

Prior to 1991, the trade and payments regime in Zimbabwe was characterized by a highly restrictive import licensing system, discretionary foreign exchange allocation, and administered setting of the exchange rate. That a wide disparity prevailed between the official and market exchange rates reflected the shortage of foreign exchange and overvaluation of the domestic currency. Subsequent reform under the Economic Structural Adjustment Program (ESAP) mostly removed import licensing, substantially dismantled foreign exchange controls, and achieved exchange rate convertibility (GATT 1995). Tariffs and other charges became the principal barrier to imports, which government policy aims to both lower and simplify over time. The effective average tariff rate was reduced from about 25 percent in 1991/92 to 16 percent in 1995/96 (IMF 1997:19). Export taxes have historically been insignificant in Zimbabwe.

In this paper we examine quantitatively the impact of trade liberalization on income growth and distribution in the Zimbabwean context. These two policy issues are particularly important for Zimbabwe, given its recent history of sluggish economic growth and persisting income inequities (Rukuni 1994). We also investigate how the income and equity effects of trade policy reform are influenced by concurrent changes in fiscal and land policies.

In terms of the overall income effect, standard trade theory shows that there are both static and dynamic gains from trade liberalization associated with increased efficiency of resource allocation and use, among other sources. The chief beneficiaries are export producing sectors, where relative incentives are made more favorable by the lower cost of

imported material inputs and higher output prices in domestic currency. In Zimbabwe the major export producers are in large-scale commercial agriculture, mining, and some industrial sectors--ownership of which are by the more affluent segment of the population. Employment in these sectors consists of both unskilled and skilled workers, which come from households of differing income levels. The direct employment impact of trade liberalization is likely to be positive, at least in the long run, given the relative abundance of (unskilled) labor in Zimbabwe. Inter-industry relations and the operation of labor markets mediate the indirect employment effect, which also has implications for income redistribution. On the consumption side, there will be differing changes in product demand — and in the derived demand for factor services — since various income groups are affected differently by the policy shift. The net effect of trade liberalization on income distribution is therefore not clear-cut.

It is possible that simultaneous changes in other aspects of the policy environment can enhance the effectiveness of trade liberalization in promoting equitable growth in Zimbabwe. As a general definition, a group of policies can be considered complementary when the effect of each policy on a given objective increases as any one of the other policies is jointly implemented. In this paper we specifically address the complementarities among trade, fiscal, and land policies toward the improvement of income growth and distribution in Zimbabwe.

It seems clear that (1) redistributing some land from large-scale commercial agriculture to smallholder households and (2) restructuring government expenditure toward smallholder agriculture are pro-equity policy measures that will affect positively the distribution of income gains from trade liberalization. But will it not reduce overall income growth? A relevant consideration is that the demand stimulus arising from the increased incomes of low-income

households will favor labor-intensive, domestically produced goods and services over capital-intensive and imported products, as earlier studies have shown for a number of developing countries.<sup>1</sup> The domestic linkage effects of those two complementary policies may serve to increase the effectiveness of trade liberalization in promoting economic growth with equity.

We make use of counterfactual simulations, based on a computable general equilibrium (CGE) model of the Zimbabwean economy — the ZimCGE model for short — recently developed under IFPRI's ongoing project on macroeconomic reforms and regional integration in Southern Africa (MERRISA), to investigate the medium-term growth and equity effects of trade liberalization in isolation and in conjunction with two alternative stylized land redistribution schemes and specific changes in government expenditure and tax policies. Such "policy experiments" serve to isolate the policy effects from other possible influences on economic performance (e.g., external market developments and weather disturbances).

The need to address distributional issues necessitates the use of an economy-wide, multi-sector model with an agricultural focus and household disaggregation. Zimbabwe's agricultural economy is extremely dualistic, warranting a distinction between the modern, large-scale commercial (LSC) farm sector and the traditional, smallholder (mostly, communal) sector (Muir 1994). These two farm sectors differ widely in land quality, production technology, infrastructure development, level of rainfall, crops planted, and household income. Our model also differentiates between owner/manager and farm-laborer households in the commercial sector, in view of marked differences in their average incomes. In urban

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<sup>1</sup> Among others, see Mellor (1976) on India, Adelman and Taylor (1990) on Mexico, Mao and Schive (1995) on Taiwan, and Delgado *et al.* (1994) on four sub-Saharan African countries.

areas, distinction is made between high-income (nonagricultural capitalist and skilled worker) and low-income (informal and unskilled worker) households. The induced relative income changes in the five household groups provide the basis for assessing the equity impact of policy experiments in the CGE model.<sup>2</sup>

Section 2 of this paper describes the structure of the ZimCGE model, whose underlying accounting framework and benchmark data derive from a recently constructed Zimbabwe SAM (social accounting matrix) for 1991 (Thomas and Bautista, forthcoming). This is followed in Section 3 by the model simulation of alternative scenarios of a liberalized trade regime, bringing out in particular the effects on aggregate household income and its distribution. The paper ends, in Section 4, with some concluding remarks.

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<sup>2</sup> The rural population accounts for about 88 percent of the poor in Zimbabwe, 81 percent coming from the smallholder-farm sector (World Bank 1995:27). The remaining rural poor (about 7 percent) are in LSC farm-worker households. The poverty share of the urban population is 12 percent, much lower than its population share of 28 percent. Our preliminary estimates of per capita income by household type indicate that high-income urban households are the most affluent (with an estimated per capita income of Z\$13,929 in 1991), followed by LSC farm-owner/manager (Z\$8,694), low-income urban (Z\$1,511), smallholder (Z\$565), and LSC farm-worker (Z\$335).

## 2. The ZimCGE Model

Representing a significant departure from earlier work,<sup>3</sup> the CGE model used in the present study has an explicit focus on agriculture, gives special attention to the distribution of rural and urban household incomes, and provides a more detailed specification of factor markets.

The ZimCGE model differentiates among 27 commodities, including 13 agricultural (maize, wheat, other grains, horticulture, coffee, tea, groundnuts, kc, tton, sugar, tobacco, other crops, cattle, and other livestock), three other primary-producing (fishery, forestry, and mining), six manufacturing (grain milling, other food processing, textiles, other light manufacturing, fertilizer, and other manufacturing), and five tertiary (electricity, construction, trade and transport, private services, and public services). As already alluded to, households are classified into three rural (communal-farm, LSC farm- owner/manager, and LSC farm-worker) and two urban (low-income and high-income). These are the same classifications used in the Zimbabwe SAM. Indeed, the ZimCGE model is built around the SAM structure and makes use of the numerical SAM for 1991 as database. The latter represents the initial conditions that will be perturbed by the policy changes postulated in the model simulations.

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<sup>3</sup> Previously, a highly aggregative CGE model for Zimbabwe, based on a 1985 SAM, has been developed and used to analyze the variability of national income in the 1980s (Davies *et al.* 1994) and the short-run effects of trade policy reform in the early 1990s (Davies *et al.* 1998), among other applications. It has no household disaggregation and distinguishes only five production sectors, where "small scale agriculture" is one sector and "commercial farming" is a part of the "exportables" sector.

### *The simplified ZimCGE model*

We describe first a simplified version of the ZimCGE model, which includes some distinctive features of the policy environment in the pre-reform benchmark year such as the administered setting of the foreign exchange rate and direct import controls.<sup>4</sup> However, it abstracts from the segmentation of factor markets and other characteristics of the Zimbabwean economy that are taken into account in the full model -- which are briefly discussed below.<sup>5</sup>

The simplified ZimCGE model follows roughly the standard neoclassical specification of general equilibrium models (Dervis *et al.* 1982, Robinson 1989). Markets for goods, factors, and foreign exchange are assumed to respond to changing demand and supply conditions, which in turn are affected by government policies, the external environment, and other exogenous influences. The model is Walrasian in that it determines only relative prices and other endogenous variables in the real sphere of the economy. Sectoral product prices, factor prices, and the foreign exchange rate are defined relative to an aggregate producer price index, which serves as the *numeraire*.

The production technology is represented by a set of nested CES (constant elasticity of substitution) and Leontief functions. Domestic output in each sector is a CES function of value added and aggregate intermediate input use. Value added is a CES function of the

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<sup>4</sup> The equations of the simplified ZimCGE model are shown in Appendix I.

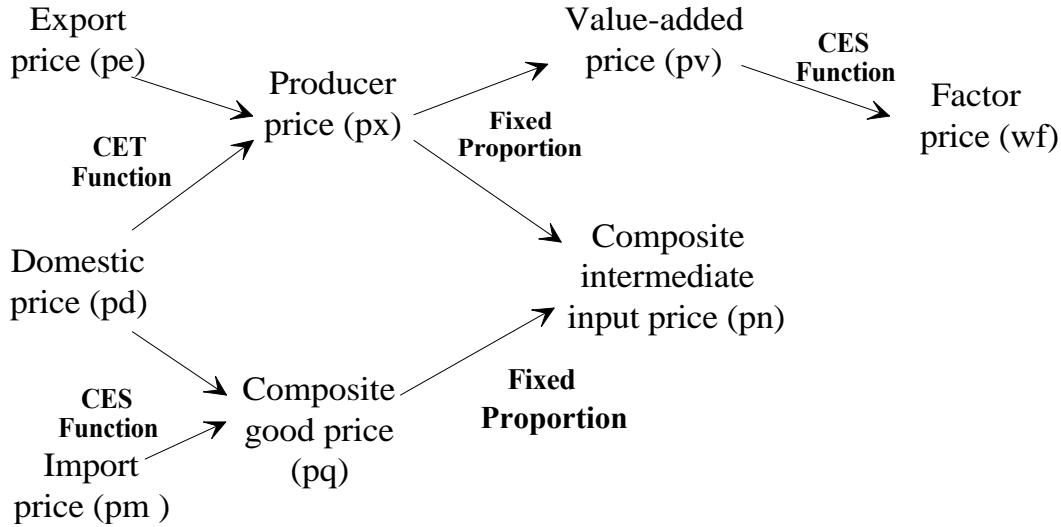
<sup>5</sup> The full model, including the specification of parameter values, is available in the format of the software (GAMS) in which the program was written, and can be obtained from the authors.

primary factors--land, capital, and the two types of labor (skilled and unskilled). Fixed input coefficients are specified in the intermediate input cost function.

The model assumes imperfect substitutability, in each sector, between the domestic product and imports. What is demanded is the composite consumption good, which is a CES (constant elasticity of substitution) aggregation of imports and domestically produced goods. Similarly, each sector is assumed to produce differentiated goods for the domestic and export markets. The composite production good is a CET (constant elasticity of transformation) aggregation of sectoral exports and domestically consumed products. Such product differentiation permits two-way trade and gives some realistic autonomy to the domestic price system (de Melo and Robinson 1981). The associated price links in the ZimCGE model are portrayed in Figure 1.

Based on the small-country assumption, domestic prices of imports and exports are expressed in terms of the exchange rate and their foreign prices, as well as the trade tax and marketing margin rates. The import tax rate represents the sum of the import tariff, surcharge, and applicable sales tax for each commodity group. The model structure gives explicit treatment of marketing margins -- at differing rates for domestic, export, and imported products. The marketing margin rate for each product type is multiplied by the composite consumption good price for "trade and transport" to obtain the marketing margin per unit quantity of the product.

**Figure 1**  
**Domestic Price Transmission Mechanism**



A fixed exchange rate regime and an endogenously determined current account balance are assumed in the base model (corresponding to the benchmark year).<sup>6</sup> Moreover, we assume that the quantitative import restrictions lead to a difference between desired imports ( $M_i^*$ ) and actual imports ( $M_i$ ), i.e.,  $M_i = qmr_i M_i^*$  where  $qmr_i$  is the quantity rationing rate on sector  $i$  imports. The domestic price of sectoral imports is unaffected by supply scarcity under the assumption of "fixprice" rationing (Dervis *et al.* 1982:293), which is reasonable for imports of producer goods (comprising the bulk of Zimbabwe's imports in 1991) and other imported products not being resold in the domestic market.

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<sup>6</sup> The foreign exchange rate, an exogenous variable in the base model, is in real terms. The deflator is the (*numeraire*) producer price index of goods for domestic use; hence, this exchange rate measure represents the relative price of tradable goods vis-a-vis nontradables (in units of domestic currency per unit of foreign currency).

Household consumption demand is based on a Cobb-Douglas utility function, with constant expenditure shares. Household and enterprise savings are specified to be in fixed proportion to after-tax incomes. Government demand by sector is given by constant shares of exogenously determined real government spending.

Aside from the supply-demand balances in the product and factor markets, three macroeconomic balances are specified in the model: (i) the fiscal balance, showing that government savings is the difference between government revenue and spending;<sup>7</sup> (ii) the external balance, equating the supply and demand for foreign exchange; and (iii) the specification that total investment is determined by total savings, which corresponds to the neoclassical macroeconomic closure (Robinson 1989).

### ***Treatment of labor markets***

Unlike the simplified version, the full ZimCGE model takes account of labor-market segmentation in Zimbabwe.<sup>8</sup> The following six labor categories can be distinguished: (1) unskilled labor in LSC farms; (2) smallholder farm labor; (3) unskilled informal labor in nonagricultural sectors; (4) unskilled formal labor in nonagricultural sectors; (5) skilled labor in LSC farms (including management); and (6) skilled labor and management in nonagricultural sectors.

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<sup>7</sup> Government capital expenditure is assumed part of government savings, which leads to an overstatement of the "fiscal balance" (or understatement of the fiscal deficit) relative to the case where capital expenditure is included as part of government spending.

<sup>8</sup> A formal specification of labor-market relationships in the full model is given in Appendix II.

For historical and institutional reasons, the unskilled labor market in the LSC farm sector is isolated.<sup>9</sup> We assume that unskilled workers in LSC farms stay within this sector, and are allocated among the different production activities based on their marginal value-added in those activities. The average wage rate for LSC farmworkers is determined through supply-demand equations that are independent of labor-market conditions elsewhere in the Zimbabwean economy.

Smallholder-farm and informal nonagricultural workers are linked to the formal, nonagricultural unskilled-labor market. Minimum wage requirements and strict anti-dismissal rules artificially raise the real wages for unskilled formal workers in nonagricultural sectors (World Bank 1995), resulting in excess labor supply. The scarcity of formal-sector jobs forces many unskilled laborers to work in the lower-paying informal nonfarm sector and smallholder farms. Given the exogenous wage rate, formal unskilled-labor employment in the nonagricultural sector is demand-determined. Subtracting this from the fixed total supply of unskilled workers (net of those working in LSC farms) yields the supply of unskilled workers for smallholder-farm and informal nonagricultural production. Demand for the latter workers is determined by their marginal products, and the market-clearing wage rate is expected to be lower than the exogenously determined formal-sector wage rate.

Skilled workers, including those occupying management positions in LSC farms and in the nonfarm sectors, are relatively scarce in Zimbabwe (Davies *et al.* 1994:157). They are assumed in the model to be fully employed, and mobile across sectors. However, there are

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<sup>9</sup> According to Masters (1994:9-10), "LSC farmworkers enjoy almost no mobility . . . and their wages bear little relation to wages elsewhere;" this isolation "is due in part to their history of state-sponsored recruitment from very low-income areas in neighboring Malawi and Mozambique" and in part to "their relative lack of education."

intersectoral differences in skilled wage rates, the average rate determined by equating the fixed supply with total demand.

### ***Land use specification***

The simplified ZimCGE model has one land category that is used in all production sectors. In the full model land appears as a factor of production in the crop sectors only. As indicated earlier, two distinct farming systems characterize Zimbabwean agriculture. Land market segmentation between smallholder and large-scale commercial farms is assumed in the model. Within each farming system, land is allocated among the various crop sectors according to its marginal value-added in those sectors.

Slightly less than five thousand LSC farms occupy 11.2 million hectares, or roughly one-third, of Zimbabwe's agricultural land. On the other hand, there are over a million communal and other small-scale farms on 21.3 million hectares. The average size of large-scale commercial farms is 2.3 thousand hectares, more than a hundred times that of communal farms. A majority (57 percent) of LSC farms are in the high-potential areas (Regions I-III). However, only a small portion (about 31 percent of arable land) is actually cultivated,<sup>10</sup> LSC cropland area amounting to about 501 thousand in 1991. Within the cultivated area, LSC farm production shows high crop yields, and is known to be economically efficient (based on domestic resource cost analysis); as pointed out by Masters (1994:43), "breaking up established LSC cropping patterns is unlikely to increase productivity." However, overall

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<sup>10</sup> This is explained analytically in Masters (1994:40-41) in terms of the negative relationship between yield per hectare planted and cropping intensity (ratio of planted to total land in LSC farms).

land use in LSC farms is inefficient, since high-potential agricultural land, one of the country's scarce resources, is being heavily underused. It has been estimated that about 1,114 thousand hectares of underutilized LSC farmland could have been used for crop cultivation in 1991 (World Bank 1995).

The smallholder sector has a much higher population density, utilizes more fully its arable land, and has lower crop yields than LSC farms. Over 70 percent of communal farms are located in the less favorably endowed Natural Regions IV and V. Total cropped area of smallholder farms in 1991 was about 3,164 thousand hectares. Based on the existing technologies, communal farms have been found to be economically efficient (Masters 1994).

### ***Intersectoral mobility of capital***

Capital is assumed mobile across all production sectors in the simplified ZimCGE model. In the full model there is capital mobility across the smallholder farm sectors and also across LSC farm sectors, but capital is sector-specific in nonagriculture.

### ***Technology differences in smallholder and LSC farms***

Consistent with the distinction made in the SAM between activities and commodities, the full ZimCGE model differentiates between smallholder and LSC production of the following "commodities:" maize, other grains, horticulture, groundnuts, cotton, other crops, cattle, other livestock, and forestry. Smallholder farms are invariably more labor-intensive, and in crop production use less fertilizer and other agricultural chemicals, than LSC farms. Imperfect substitutability is assumed between smallholder and LSC farm products of the same

commodity. There are 36 production activities in the SAM and the full model, nine more than the number of commodities (27).

### ***Own-household consumption***

The full model takes account of home consumption of the following smallholder farm products: maize, other grains, horticulture, groundnuts, cattle, other livestock, and forestry. The amounts of own-household consumption of these products are assumed not to change from the benchmark values contained in the 1991 SAM.

## **3. Simulation Analysis**

The benchmark SAM for 1991, which is replicated as the base solution of the full ZimCGE model, provides the initial conditions that are perturbed by the policy changes postulated in the model simulations. Trade liberalization is represented in our policy experiments as the removal of non-tariff barriers (including import rationing and surtax), adjustment of tariffs to a low uniform rate, and dismantling of foreign exchange controls. In addition, we also examine the alternative scenario of trade liberalization combined with the adjustment of direct taxes to compensate for the decline in government revenue from trade taxes. More specifically,

- **Simulation I** (Trade liberalization): Set the quantity rationing rates ( $qmr_i$ ) equal to one, and the tariff rates ( $tm_i$ ) equal to 0.10; also, endogenize the foreign exchange rate (EXR) and fix the current account balance (CAB).

- **Simulation II** (Trade liberalization with adjustment of direct taxes): Add to Simulation I uniform tax rate increases on the incomes of enterprises ( $\epsilon_{tax}$ ) and on the two affluent household groups ( $htax_h$ ), LSC farm owner/manager and high-income urban households, that leave government savings (GOVSAV) unchanged.

Next, the complementarity of trade liberalization with land reform is investigated. Simultaneous changes in trade, fiscal, and land policies are considered in these model simulations, which involve two alternative, highly stylized land redistribution schemes of contemporary relevance in Zimbabwe. In one land reform scenario, which does not allow the subdivision of agricultural land, 50 percent of whole LSC farms are purchased by the government and redistributed in small portions to smallholders. The LSC sector loses one half of its cropland area, which is added to the smallholder sector together with one half of the LSC unutilized arable land. In the other land reform scenario, LSC farmland is allowed to be subdivided; unutilized arable land in LSC farms is fully transferred to smallholders but LSC cropland area is unchanged. Considering the current uncertainty about government purchase prices of LSC farmland for redistribution, the simulation analysis here abstracts from the intersectoral income flows (involving the government, farm household groups, and possibly also the foreign sector) associated with the land transfers.<sup>11</sup> Land taxes are also introduced in both cases that will finance increases in government expenditures on construction and public services directed to the resettlement of smallholder households and

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<sup>11</sup> Consistent with this approach, it can be assumed, for example, that in both land reform scenarios, purchase of the redistributed LSC farmland is made by issuing government bonds that will mature after the simulation period.

productivity improvement in the two most promising crops for increased smallholder production, namely, cotton and horticulture. More specifically,

- **Simulation III** (Trade liberalization, direct tax adjustment, and land reform A): Add to Simulation II the following: (1) reduction of total LSC cropland area by one half and expansion of smallholder cropland area by one half of the initial LSC arable area; (2) land taxation at Z\$20 per hectare on LSC farms; (3) increases in government expenditure on construction and public services that are assumed to lead to a 20 percent increase in total factor productivity for smallholder cotton and horticulture.
- **Simulation IV** (Trade liberalization, direct tax adjustment, and land reform B): The same as Simulation III except that (1) is replaced by (1'): no reduction in total LSC cropland area, and expansion of smallholder cropland area by the total unutilized LSC arable land area.

The comparative effects of these policy experiments on selected variables are shown in Table 1. The overall income measure, representing aggregate disposable income in real terms, is the sum of gross incomes of the five household groups net of direct taxes deflated by the general consumer price index (CPI). Trade liberalization alone (Simulation I) increases overall or aggregate household income by more than 4 percent. However, government revenue is reduced by nearly 15 percent, implying that the positive effect of the larger income tax base does not fully offset the drastic reduction in tariff revenue. Indeed, government "dissaving" (current expenditure minus current revenue) increases nearly three-fold (from the base value of Z\$556 million to Z\$1,539 million), which would have worsened an already fragile fiscal situation in 1991 (see GATT 1995). Exports expand significantly in response to the marked depreciation of the real exchange rate. Imports also increase (but to a lesser

extent than exports), owing to the removal of quantity rationing and tariff rate cuts. Similar magnitudes of trade changes can be observed from the results of the other policy experiments.

The induced changes on real disposable incomes of specific household groups (deflated by their respective CPIs) under Simulation I indicate that the largest proportional benefits accrue to the two LSC farm households, reflecting the heavy export orientation of LSC production. That urban households also show large income gains can be attributed to the induced growth in nonagricultural exports and the increased domestic expenditure for nonagricultural products. Lastly, smallholder households are seen to benefit the least from trade liberalization.

In Simulation II, which constrains government saving to stay unchanged at the base level, a uniform 3 percentage-point increase in direct tax rates for enterprises and the two affluent household groups is found to compensate fully for the decline in government revenue due to tariff reduction (from Z\$1,861 million, or 23.1 percent of import value, in 1991 to Z\$958 million). The household-income effects remain positive, except for high-income urban households (whose tax payment has increased). The income benefits are generally smaller relative to Simulation I. Aggregate household income rises by less than one percent, with the high-income LSC households understandably showing a substantial reduction in income gain. Thus, trade liberalization and the associated direct tax adjustment are complementary policies that advance the objectives of overall income growth and equity, relative to the 1991 benchmark conditions in Zimbabwe. However, relative to Simulation I, the results of Simulation II include a much lower increase in aggregate household income as a negative outcome of maintaining the base level of government saving.

Jointly implementing land reform that transfers one half of LSC farmland, both cultivated and unutilized, to smallholders (Simulation III) is seen to lead, not surprisingly, to an unfavorable outcome for the two LSC household groups.<sup>12</sup> Smallholder household income improves by more than one percentage point relative to Simulation II. That the income gain to low-income urban households increases (but not to high-income urban households) is presumably related to the expansion of labor-intensive nonagricultural products (stimulated on the demand side by the rise in smallholder household income) and the derived demand for unskilled and informal labor. Growth in aggregate household income turns negative, so this particular land redistribution scheme (land reform A), while possibly improving equity, does not advance the overall income growth objective.

Finally, in Simulation IV, which does not involve a reduction in LSC crop area but increases smallholder cropland by the total unutilized area in LSC farms, the results indicate consistently much larger income benefits for the household groups individually and in aggregate relative to Simulation III. Growth in aggregate household income is now positive and nearly double that in Simulation II. The real disposable income of LSC farm owner/manager households declines, albeit to an insignificant extent, owing to the payment of a higher income tax rate and a new land tax. The proportional income gains for the LSC farm-worker, smallholder, and low-income urban households are substantial, and far exceed those for the high-income LSC and urban households, unambiguously indicating a positive equity impact. This land redistribution scheme (land reform B) and the associated changes

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<sup>12</sup> Notably, despite the increased depreciation if the real exchange rate (by 10.3 percent relative to the base level), LSC production and exports of tobacco declined by 8.1 and 7.0 percent, respectively.

in government expenditure and tax policies are therefore complementary to trade liberalization in promoting the twin objectives of overall income growth and equity.

#### **4. Concluding Remarks**

This paper has investigated quantitatively the economywide income and equity effects of trade liberalization in Zimbabwe, considered in isolation and in combination with potentially complementary changes in fiscal and land policies. A static, agriculture-focused CGE model for Zimbabwe with 1991 as base period is presented and used to generate simulation results of the alternative policy regimes. Given the well-known limitations of static CGE analysis, the numerical results are necessarily illustrative and should be given less significance than the orders of magnitude and comparative findings.

One important finding is that trade policy reform alone (dismantling of import and foreign exchange controls, and reduction of import taxes to a low uniform rate) increases aggregate disposable household income significantly. However, the least income gain accrues to smallholder households, which account for about four-fifths of the poor in Zimbabwe, so the equity impact is unfavorable. Furthermore, the substantial loss in import tax revenue renders this policy option unattractive, and perhaps infeasible, against the background of an already large fiscal deficit in 1991 (Takavarasha 1993). It suggests the need to implement an effective tax reform — if government income is to be protected — as the trade regime is being liberalized.

Our model simulation of adjusting direct tax rates (on incomes of enterprises and the two affluent household groups) to compensate for the decline in import tax collection and keep

government dissaving at the base level leads to an improvement in both aggregate household income and its distribution from base period conditions. However, compared to the policy experiment of trade liberalization alone, household income gains are generally much lower. Concurrent implementation of the foregoing policy experiment with two alternative land reform scenarios is shown to result in divergent outcomes in terms of their income and equity effects. The simulation results support the conclusion that, with an effective land reform and restructuring of government expenditure and taxation, the substantial progress achieved under ESAP in reforming trade and exchange rate policies in Zimbabwe could have helped promote the twin objectives of overall income growth and equity.

More generally, complementarities between trade policy and other aspects of the domestic policy environment are potentially significant. Failure to undertake complementary policies may help explain why trade liberalization efforts in many African countries have not contributed significantly to egalitarian growth. There is a need to seek out, in specific country context, policy complementarities that advance multiple objectives simultaneously.

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**Table 1 -- CGE model simulation results**  
(percentage changes from base values)

	Simulation I	Simulation II	Simulation III	Simulation IV
Real aggregate disposable household income	4.16	0.66	-0.53	1.29
Government revenue	-14.60	1.67	1.63	2.75
Government expenditure	1.71	1.52	1.49	2.52
Total exports	20.65	23.22	22.86	23.64
Total imports	19.06	21.46	21.36	21.74
Real exchange rate	7.31	8.44	10.26	7.64
Real disposable household incomes				
LSC farm-owner/manager	4.76	0.20	-2.19	-0.01
LSC farm-worker	10.55	12.30	1.11	11.63
Smallholder	3.82	3.42	4.49	4.87
High-income urban	3.91	-0.36	-1.49	0.32
Low-income urban	4.06	3.87	4.25	5.87

Notes:

Simulation I -- Trade liberalization alone

Simulation II -- Trade liberalization plus direct tax adjustment

Simulation III -- Trade liberalization and direct tax adjustment plus land reform A

Simulation IV -- Trade liberalization and direct tax adjustment plus land reform B

(See text for further description of model simulations.)

Export and import values are in domestic currency.

The exchange rate is in units of domestic currency per unit of foreign currency, so that an increase (a decrease) indicates a depreciation (an appreciation).

## Appendix I -- Equations of the simplified ZimCGE model

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### Production and Cost Functions

1.  $X_i = CES(V_i, N_i)$  Production function.
2.  $V_i = a_i CES[K_i, LND_i, LS_i, LU_i]$  Value added function.
3.  $PN_i = \sum_j a_{ji} \cdot PQ_j$  Intermediate input cost function.

### Prices and Input Demand

4.  $PM_i = pwm_i(1 + tm_i)\overline{EXR} + mm_i \cdot PQ_{tt}$  Import price.
5.  $PE_i = pwe_i(1 - te_i)\overline{EXR} - me_i \cdot PQ_{tt}$  Export price.
6.  $PX_i = \frac{[PD_i - md_i \cdot PQ_{tt}]D_i + PE_i \cdot E_i}{X_i}$  Average producer price.
7.  $PQ_i = \frac{PD_i \cdot D_i + PM_i \cdot M_i}{Q_i}$  Composite good price.
8.  $PV_i = \frac{PX_i \cdot X_i - PN_i \cdot N_i}{V_i}$  Value added price.
9.  $PK_i = \sum_j b_{ji} \cdot PQ_j$  Composite capital good price.
10.  $\bar{P} = \sum_i w_i \cdot PD_i$  Numeraire producer price index.
11.  $\frac{N_i}{V_i} = CES^{\zeta}\left(\frac{PN_i}{PV_i}\right)$  Intermediate input demand.

$$12. \quad h_{fi} \cdot WF_f = \frac{\partial V_i}{\partial F_{fi}} \cdot PV_i$$

Demand for factors.

### Product Supply and Demand

$$13. \quad X_i = CET(D_i, E_i)$$

Gross domestic output.

$$14. \quad \frac{E_i}{D_i} = CET\left(\frac{PE_i}{PD_i(1 - md_i \cdot PQ_{it})}\right)$$

Export supply.

$$15. \quad Q_i = CES(D_i, M_i)$$

Composite good.

$$16. \quad \frac{M_i}{D_i} = qmr_i \cdot CES\left(\frac{PM_i}{PD_i}\right)$$

Import demand.

### Incomes and Savings

$$17. \quad YF_f = \sum_i h_{fi} \cdot WF_f \cdot F_{fi}$$

Factor income.

$$18. \quad YH_h = \sum_f s_{hf} \cdot YF_f + s_{he} \cdot YENT(1 - etax)(1 - esav) \\ + \overline{GTH}_h + \overline{HHREM}_h + \overline{EXR} \cdot \overline{HFREM}_h$$

Household income  
( $\sum_h \overline{HHREM}_h = 0$ ).

$$19. \quad YENT = \sum_f s_f \cdot YF_f + \overline{GTE}$$

Enterprise income.

$$20. \quad YGOV = \overline{EXR} \sum_i (pwm_i \cdot M_i \cdot tm_i + pwe_i \cdot E_i \cdot te_i) \\ + \sum_h YH_h \cdot htax_h + YENT \cdot etax \\ + \overline{EXR} \cdot \overline{NFB}$$

Government income.

$$21. \quad HSAV = \sum_h YH_h \cdot (1 - htax_h) \cdot hsav_h$$

Household savings.

$$22. \quad ENTSAV = YENT \cdot (1 - etax) \cdot esav$$

Enterprise savings.

$$23. \quad SAVING = HSAV + ENTSAV + GOVSAV \\ - \overline{EXR} \cdot \overline{CAB}$$

Total savings.

### Expenditures

24.  $INT_i = \sum_j a_{ij} \cdot N_j$  Sectoral intermediate demand.
25.  $HCD_i = \frac{\sum_h [hc_{ih} \cdot YH_h \cdot (1 - hsav_h) \cdot (1 - htax_h)]}{PQ_i}$  Household consumption.
26.  $GCD_i = gc_i \cdot \overline{GOVCON}$  Government consumption.
27.  $ID_i = id_i \cdot \overline{FXDK}$  Sectoral fixed investment demand.
28.  $INVEST = \sum_i PQ_i \cdot (\overline{STK_i} + ID_i)$  Total investment.
29.  $QT_{tt} = \sum_i (mm_i \cdot M_i + me_i \cdot X_i + md_i \cdot D_i)$  Demand for marketing services.

### Supply-Demand Balances

30.  $Q_i = INT_i + HCD_i + GCD_i + ID_i + \overline{STK_i} + QT_i$  Product markets ( $QT_i = 0$  for  $i \neq tt$ ).
31.  $\overline{F_f} = \sum_i F_{fi}$  Factor markets.
32.  $CAB = \sum_i (pwe_i \cdot E_i - pwm_i \cdot M_i) + \sum_h \overline{HFREM_h} + \overline{NFB}$  Foreign exchange market.
33.  $GOVSAV = YGOV - \sum_i PQ_i \cdot GCD_i - \sum_h \overline{GTH_h} - \overline{GTE}$  Fiscal balance.
34.  $SAVING = INVEST$  Macro closure.

## NOTATION

### Endogenous variables

$X_i$	=	gross domestic output
$V_i$	=	value added input
$N_i$	=	composite intermediate input used by sector i
$K_i$	=	capital input
$LND_i$	=	land input
$LS_i$	=	skilled labor input
$LU_i$	=	unskilled labor input
$PM_i$	=	domestic price of imports
$PE_i$	=	domestic price of exports
$PQ_i$	=	composite good price
$PD_i$	=	price of domestically produced good for domestic market
$PX_i$	=	average producer price
$PV_i$	=	value added (or net) price
$PN_i$	=	composite intermediate input price
$PK_i$	=	composite capital good price
$WF_f$	=	nominal factor return
$M_i$	=	imports
$E_i$	=	exports
$Q_i$	=	demand for composite good
$D_i$	=	domestic demand for domestically produced good
$YF_f$	=	factor income
$YH_h$	=	household income
$YENT$	=	enterprise income
$YGOV$	=	government income
$F_{\hat{f}}$	=	factor demand
$HS AV$	=	household savings
$ENTSAV$	=	enterprise savings
$GOVSAV$	=	government savings
$SAVING$	=	total savings
$INT_i$	=	intermediate demand
$HCD_i$	=	household consumption demand
$GCD_i$	=	government consumption demand

$INVEST$	=	total investment
$ID_i$	=	sectoral fixed investment demand
$QT_i$	=	demand for marketing services (for $i=tt$ )
$CAB$	=	current account balance (in U.S. dollars)

**Exogenous variables** (indicated above with a bar)

$P$	=	numeraire producer price index
$GTH_h$	=	government transfer to household
$GTE$	=	government transfer to enterprise
$HHREM_h$	=	remittances from other households
$HFREM_h$	=	foreign remittance to household (in U.S. dollars)
$NFB$	=	net foreign borrowing (in U.S. dollars)
$GOVCON$	=	total government consumption
$STK_i$	=	inventory investment by sector
$FXDK$	=	total fixed investment
$F_f$	=	aggregate factor supply
$EXR$	=	foreign exchange rate (Zimbabwe dollars/U.S. dollar)

**Parameters**

$a_i$	=	total factor productivity
$a_{ji}$	=	input-output coefficients
$pwm_i$	=	world price of imports
$pwe_i$	=	world price of exports
$tm_i$	=	import tax rate
$te_i$	=	export tax rate
$mm_i$	=	marketing margin rate on imported products
$me_i$	=	marketing margin rate on export products
$md_i$	=	marketing margin rate on domestic products for internal use
$qmr_i$	=	import quantity rationing rate
$w_i$	=	weights in composite price index
$h_{fi}$	=	factor price proportionality constant
$s_{hf}$	=	household share in factor income
$s_{kf}$	=	enterprise share in factor income
$s_{he}$	=	household share in distributed enterprise income
$hsav_h$	=	household saving rate

$esav$	=	enterprise saving rate
$htax_h$	=	household tax rate
$etax$	=	enterprise tax rate
$hc_{ih}$	=	household expenditure share
$gc_i$	=	government expenditure share

### Functions

$CES$	=	constant elasticity of substitution function
$CES^{\zeta}$	=	relation derived from cost minimization in a CES
$CET$	=	constant elasticity of transformation function
$CET^{\zeta}$	=	relation derived from revenue maximization in a CET

### Indexes

$i, j$	=	production sectors (maize, wheat, other grains, horticulture, coffee, tea, groundnuts, cotton, sugar, tobacco, other crops, cattle, other livestock, fishery, forestry, mining, grain milling, other food processing, textiles, other light manufacturing, fertilizer, other manufacturing, electricity, construction, trade and transport (tt), private services, public services)
$f$	=	factors (land, capital, skilled labor, unskilled labor)
$h$	=	households (smallholder, LSC-farmworker, LSC-owner/manager, low-income urban, high-income urban)

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## Appendix II: Labor market specification in the full ZimCGE model

### 1. Formal, unskilled labor in non-agriculture sectors

Labor demand: 
$$h_{fui} \cdot \overline{W}_{fu} = \frac{\partial V_i}{\partial L_{fui}} \cdot PV_i \quad i \in na$$

Supply-demand balance: 
$$L_{fu} = \sum_{i \in na} L_{fui}$$

### 2. Informal (unskilled) labor in non-agriculture sectors and smallholder farm labor

Labor demand: 
$$h_{ni} \cdot W_n = \frac{\partial V_i}{\partial L_{ni}} \cdot PV_i \quad i \in na, sh$$

Supply-demand balance: 
$$\overline{L}_u - L_{fu} = \sum_{i \in na, sh} L_{ni}$$

### 3. Unskilled labor in large-scale commercial agriculture

Labor demand: 
$$h_{ui} \cdot W_{ul} = \frac{\partial V_i}{\partial L_{uli}} \cdot PV_i \quad i \in ls$$

Supply-demand balance: 
$$\overline{L}_{ul} = \sum_{i \in ls} L_{uli}$$

### 4. Skilled labor in large-scale commercial agriculture and non-agriculture sectors

Labor demand: 
$$h_{si} \cdot W_s = \frac{\partial V_i}{\partial L_{si}} \cdot PV_i \quad i \in na, ls$$

Supply-demand balance: 
$$\overline{L}_s = \sum_{i \in na, ls} L_{si}$$

## NOTATION

### Endogenous variables

$L_{fui}$	=	formal, unskilled labor employment in non-agriculture sectors
$L_{fu}$	=	total employment of formal, unskilled workers in non-agriculture
$L_{uli}$	=	unskilled labor employment in large-scale commercial agriculture sectors
$L_{ni}$	=	employment of informal labor in non-agriculture and farm labor in smallholder agriculture sectors
$L_{si}$	=	skilled labor employment in non-agriculture and large-scale commercial agriculture sectors
$W_{ul}$	=	average wage rate for unskilled labor in large-scale commercial agriculture
$W_n$	=	average wage rate for informal labor in non-agriculture and farm labor in smallholder agriculture
$W_s$	=	average wage rate for skilled labor in non-agriculture and large-scale commercial agriculture

### Exogenous variables (indicated above with a bar)

$\bar{W}_{fu}$	=	average wage rate for formal unskilled labor in non-agriculture
$\bar{L}_{ul}$	=	supply of unskilled labor in large-scale commercial agriculture
$\bar{L}_u$	=	aggregate supply of unskilled labor for non-agriculture and smallholder agriculture
$\bar{L}_s$	=	supply of skilled labor (including managers) for non-agriculture and large-scale commercial agriculture

The  $h$  parameters are constants of proportionality that indicate the disparity of the actual wage rate from the marginal value-added of each labor type in a given sector.

Sets  $sh$ ,  $ls$ , and  $na$  consist of production sectors in smallholder agriculture, large-scale commercial agriculture, and non-agriculture, respectively.