

# Zimbabwean trade liberalisation: *ex post* evaluation

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The recent trade liberalisation in Zimbabwe offers an opportunity of understanding short-run adjustment responses to reform. The immediate experience involved contraction in output and employment, a consumption boom, the inflow of imports and a rising trade deficit. The analytical challenge is to disentangle the effects of liberalisation from the serious drought that coincided with it. An economy-wide CGE model is used for counterfactual experiments. The opening-up of final goods markets is shown to contribute to deindustrialisation and contraction.

## 1. Introduction

Governments presumably embark on trade liberalisation programmes to gain long-term benefits from competition and comparative advantage. Whatever the long-run implications, reforms are often postponed and opposed on account of adjustment costs. The short-run consequences of trade liberalisation are addressed here, based on the experiences in Zimbabwe.

Regulation of foreign trade has been a key feature of the Zimbabwean economy for three decades. During the UDI period (Unilateral Declaration of Independence) between 1965 and 1980, international sanctions, and domestic policies to cope with them, induced import-substituting industrialisation. A sophisticated import control system was built up, which the new government continued to use after independence in 1980. The post-independence boom of 1980–82 was unsustainable on foreign exchange grounds, and the government resorted to administered foreign exchange allocation to control the current account deficit. This policy led to macroeconomic stability, but restricted growth. Green and Kadhani (1986) wrote the authoritative account of the early independent period.

Since the mid-1980s, a number of institutional responses to deal with the linkage between import capacity and economic growth have been introduced, basically aimed at export promotion. The measures have not been without effect, and the relaxation in the foreign exchange constraint can be observed as rising growth rates in the last part of the decade. In view of the relative success of the modified protectionism, this looked like a long-run solution for a government of socialist inclination and rhetoric.

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To the surprise of most observers, the government then chose to go for full trade liberalisation, in fact more radical than most developing countries. It must be understood against a background of increased political pressure to join the international trend of liberal economic reform. Outside Zimbabwe, both donors and the Bretton Woods institutions argued for liberalisation and would increase funding. Inside the country, the powerful Confederation of Zimbabwe Industries changed its opposition to trade liberalisation around 1987–88. Skålnes (1995) reports increasing concerns about the growth effects of regulation inside the ruling party ZANU (PF).

The Economic Structural Adjustment Programme (ESAP) was announced in July 1990 (Government of Zimbabwe, 1991). The programme contains all the elements of the orthodox Washington package, and trade liberalisation has been the main area of action. Trade reform was designed to be gradual and implemented over the 1990–95 period, but in fact implementation was swift. By 1994, all current transactions were outside government control, and the only restrictions left on the capital account concerned returns to investments made before independence and holding foreign assets abroad.

The economy has not responded favourably to quick trade liberalisation. The immediate experience involved contraction in output and employment, a consumption boom, the inflow of imports and a rising trade deficit. The timing of the reform was unfortunate, since it coincided with serious drought in 1992. The analytical challenge is to disentangle the effects of drought from liberalisation, and to investigate how alternative policies could have helped the adjustment process.

Based on our perception of the stylised facts of the Zimbabwean economy, a CGE model emphasising real-side sectoral balances and macroeconomic interactions has been constructed. The starting point is a model representing the import compression regime at work through the 1980s, as analysed by Davies, Rattsø and Torvik (1994). Import rationing allocates intermediates and investment goods, and also includes importables and food, and the domestic markets for importables and food are protected from international competition. Trade liberalisation is analysed as a regime shift imposed on the benchmark import-rationing model, eliminating controls.

The experiences of trade liberalisation in Zimbabwe, as they can be assessed at this early stage, are discussed in section 2, which sets out the issues to be analysed. The various expansionary and contractionary elements involved in the short-run adjustments are spelled out in section 3, and serve as a theoretical foundation for the model analysis. The CGE model and its use are presented in section 4. The analysis follows in two parts. Section 5 shows the consequences of intermediate liberalisation, opening up for free imports of intermediates, as implemented in 1990–91. This section basically provides an understanding of the adjustment mechanisms of limited liberalisation, often recommended as the first stage of reform. Section 6 includes liberalisation of trade in competitive and non-competitive final goods, 'full' liberalisation, and tries to sort out liberalisation effects from drought. Since trade liberalisation is easily contractionary, it is of interest to study possible policy initiatives to avoid contraction. The counterfactual assumed to keep output constant is analysed in section 7. Finally concluding remarks are offered.

## **2. Trade liberalisation in Zimbabwe**

The government had a team of UNDP-funded Australian economists working on possible trade reforms for a couple of years, but still the policy announcement of ESAP in

the summer of 1990 came as a surprise. The seriousness of the policy intentions was shown in October 1990, when raw materials and inputs to industries were put on a list of Open General Import License (OGIL). Industries in key sectors such as cement, textiles and mining had free access to imported inputs. This part of the programme can be called phase 1 1990–91, *intermediate liberalisation*, since the consequences of the first step are very different from those that follow. Already early in the autumn of 1991, liberalisation was extended to include imported final goods. At first, the extension was part of the gradualist approach, and new items were put on the OGIL list. The Export Retention Scheme (ERS) introduced in the spring was broadened, and all exporters were entitled to 15% of export revenues in foreign exchange. Internal trade with ERS imports developed and an unofficial foreign exchange market was set up. This we shall call phase 2, 1991–92, *full liberalisation*, and is the main period of interest in this paper.

Later, trade liberalisation took on its own dynamics. In the summer of 1993 the process accelerated with new extensions of the export retention and free trade with ERS entitlements. Individuals were allowed to open foreign exchange accounts, and a dual foreign exchange market developed with an official and an ERS exchange rate. Later, the corporate sector was allowed to open foreign exchange accounts. External borrowing was allowed and exchange controls were relaxed (e.g., travel). The opening-up to foreign capital flows was partly motivated by the high cost of domestic private credit. During 1994, the exchange rates were unified. At this stage, Zimbabwe became an extremely open economy. The only restrictions left on the capital account concern returns to investments made before independence and holding foreign assets abroad.

The database to evaluate the experiences of the 1990s is clearly still limited, but the broad picture is clear except for investments and savings. The economy expanded during trade liberalisation phase 1, 1990–91, as expected and contracted during phase 2, 1991–92, with drought. Compared to trend growth, output fell by about 10% in 1992. In 1993, the Gross Domestic Product had still not returned to the 1990 level, as reported in Table 1.

Since exports did not get new major incentives, the trade balance had to worsen. Furthermore, the lack of devaluation and the uncertainty of the process led to hoarding of imported goods. Merchandise imports rose by more than 20% on an annual basis. Real exports fell and the 1993 merchandise exports were still below the 1990 figure (measured in US dollars). The trade deficit at its worst reached 20% of GDP (when measured with a corrected 'equilibrium' exchange rate). The foreign debt accumulated fast during the liberalisation process in a country that previously had shown prudent control and independence from international financial markets.

The structural change observed so far must be described as deindustrialisation.

**Table 1.** *Macroeconomic performance, 1990–94*

	1990	1991	1992	1993	1994
GDP growth %	+2.2	+4.3	-6.2	+2.1	+4.5
Exports, mill. US\$	1750	1690	1530	1580	1700
Imports, mill. US\$	1510	1700	1780	1460	1600
Current account deficit, % of GDP	2.5	8.8	13.6	2.9	na
Index manufacturing output (1980 = 100)	139	143	130	119	127

Sources: Central Statistical Office and World Bank; estimates; 1993 and 1994 figures are preliminary.

Manufacturing output fell by more than 20% from its peak in spring 1991. The index of manufacturing output (based on firms registered in 1980) shown in Table 1 indicates that the industrial contraction has been turned around, but output is still well below 1991 figures. If performance is compared to trend, the drop in manufacturing output is even larger. It is an interesting question whether liberalisation has prepared the ground for future industrialisation.

On the monetary side (the details of which are outside the scope of this study), inflation early in the programme reached a peak close to an annual rate of 50%. The drought must take some of the blame, together with deregulation of domestic markets. The inflation led to dramatic cuts in real wages and thereby a shift in the income distribution away from urban unskilled labour. The interest-rate level drifted up with inflation and reached a peak with an extreme real loan rate of about 20%, related to the continued public deficit of about 10% of GDP.

Trade liberalisation has seriously changed the conditions for production and distribution. Phase 1 gave easier access to imported intermediates and raw materials, and an overall expansion of import-dependent activities was expected. The delayed devaluation kept imported inputs cheap although some tariffs and charges were imposed. Opening up for free imports of inputs basically allowed the protected, domestically oriented industries to expand and involved no structural change. Firms with the most restricted access to imports before liberalisation, of course, benefited most. No shift from domestically oriented to export activities is observed and exports stayed on trend during 1991.

Phase 2 and later changed the conditions for import-competing industries dramatically. They had been protected from competition for decades. The inflow of imported final goods made many domestically oriented manufacturing firms unprofitable. Imports crowded out domestic production. The negative effect on industrial production was influenced by the 1992 drought, with reduced agricultural income and demand and reduced access of inputs from agriculture to industrial processing. Other aspects of the adjustment process were important too. The interest rate shock associated with financial liberalisation raised the costs of working capital, and real wages dropped substantially with the overall rise in inflation.

Our analysis can throw some light on the economic responses to the trade reform. By integrating import-rationing policies in an economy-wide model, the effects of partial intermediate liberalisation can be traced. Liberalisation on the input side is combined with import controls of final goods. When full liberalisation coincided with agricultural drought, a model is needed for a counterfactual analysis of liberalisation without drought.

### 3. Short-run consequences of trade liberalisation: theory

The standard welfare analysis of trade liberalisation is based on a model assuming full utilisation of resources. Trade liberalisation is shown to improve resource allocation, since imperfections disturbing marginal efficiency conditions are eliminated. Static misallocation costs of trade restrictions are generally shown to be small. The introduction of rent-seeking has added to the estimates of possible gains. CGE studies addressing trade liberalisation include Benjamin (1992), Condon *et al.* (1985), and Grais *et al.* (1986).

The more recent literature emphasises the macroeconomic context of liberalisation, as in Collier and Gunning (1992). Even in models of full employment, credibility problems may lead to unfavourable outcomes regarding trade balance and investment. Here we

realistically assume unemployment of unskilled labour, opening up for a possible effect on total employment. Theoretical studies by Buffie (1984) and Ocampo (1987) have shown that trade liberalisation can be contractionary in this situation. Ocampo emphasises demand switching, while Buffie assumes higher intermediate import costs. Demand switching may reduce output from import-competing domestic industries. The mechanism can be seen as an example of forced import substitution following from restrictions on imports—the rationale for proposals of the Cambridge Economic Policy Group to impose import controls in order to increase employment (see Cripps and Godley, 1978). In our context, the total employment effect depends on the strength of the supply responses in other sectors, particularly exportables.

The core of the action during trade liberalisation takes place in import-dependent and import-protected sectors, typically manufacturing in sub-Saharan Africa. To sort out the various effects, we concentrate on one such sector in Figure 1. The supply function is upward sloping because of fixed capital stock, implying increasing marginal costs. The supply curve under intermediate rationing is drawn as a solid line, and is steeper when rationing bites. Reduced availability of imported intermediates can be compensated for only imperfectly by domestic intermediates, and marginal costs are increasing for the intermediates aggregate. The rationing system offers the producers commodity-specific licences for intermediates, and they are not allowed to resell. Clearly this system motivates rent-seeking, and the costs associated with rent-seeking are another possible source of steeper marginal costs, as suggested by Grais *et al.* (1986). In Zimbabwe, the licence-holders were old clients of the government, and observers agree that costs associated with rent-seeking have not been important. Licence-holders do get an implicit rent as a result of the rationing. Rationing means a higher price of the finished good in the protected domestic market than otherwise would be the case.

This leads us to the other important aspect of import rationing, the protection of domestic final goods markets. The import compression has almost eliminated both importables and non-competitive consumer goods imports. And a domestic market for the imports allowed has barely existed. This is surprising, but motivates our assumption of fixed price-rationing of final goods where the rents are handed to the government.

Two effects of this protection are captured on the demand side. First, demand switches

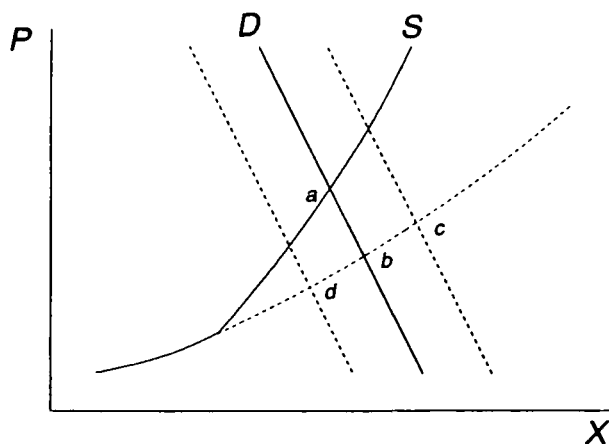


Fig. 1. Effects of trade liberalisation.

to domestic goods when foreign goods are not available. Neary and Roberts (1980) have suggested a modification of the linear-expenditure formulation under rationing applied here. Since consumer imports are rationed, the ratio of imported to domestically produced consumption is lower than desired at the prevailing prices. The notional price of consumer imports is higher than the actual. Second, when demand for imports is not satisfied, part of the income can be set aside as savings—in the expectation of less severe rationing in the future. A theoretical justification is offered by Torvik (1993). Empirical evidence is identified by Chhibber *et al.* (1989) and Morande and Schmidt-Hebbel (1991). In this study, the stylised fact is taken care of by linking private savings rates to the rationing of non-competitive imports. The mechanisms may also be important to explain the savings of private firms.

Trade liberalisation is analysed by eliminating the rationing in two phases. The first, intermediate liberalisation, does away with rationing of intermediate imports. Figure 1 captures the expansionary supply effect, and the supply curve shifts outwards to the dotted line. Given the demand curve  $D$ , output will expand from  $a$  to  $b$ . Under our assumption of a fixed nominal wage of unskilled labour and overall unemployment, total employment can increase. The notional price of imported inputs falls. This is the opposite effect of the contractionary liberalisation analysed by Buffie (1984). In his model, a higher relative price of imported inputs explains possible output contraction.

The second phase, full liberalisation, adds free trade in importables, non-competitive consumer goods and food to intermediate liberalisation. The elimination of protection adds demand effects to Figure 1. Two counteracting forces can be identified. On the one hand, private savings rates are reduced when foreign goods are made available, and the consumption demand goes up, given the income level. Since the stock of wealth accumulated under rationing can be higher than desired under liberalisation, the immediate flow-effect on consumption can be quite large. If demand expansion dominates, we may end up in an equilibrium like  $c$  in Figure 1. Both supply and demand factors are expansionary under liberalisation. On the other hand, demand switches to imports since consumers have been forced to hold an inefficient mix of domestic and foreign goods. This effect tends to shift the demand curve to the left, possibly ending up in an equilibrium like  $d$  in Figure 1, with output contraction as a result of liberalisation. The analysis below attempts to quantify these shifts and to draw some conclusion regarding net effects.

#### 4. Modelling trade liberalisation

The full economy-wide interactions are captured in a computable general equilibrium model emphasising the real side. The benchmark model version of import regulation is constructed and documented by Davies *et al.* (1994), and 1985 is used as the base year. The model brings together two types of dual model familiar from development economics. The dependent economy model distinguishing between traded and non-traded goods can be seen as a starting point. With a view to including terms of trade effects and differences in import rationing, traded goods' production is disaggregated to importables, exportables and food agriculture. De Melo and Robinson (1989), Bevan *et al.* (1990) and Devarajan *et al.* (1991) argue for a disaggregation of the traded sector in developing countries. The exportables are often raw materials, agricultural crops etc., while the importables have the characteristics of manufacturing goods and, in sub-Saharan Africa, foodstuffs. Since production structure and demand linkages differ, non-

traded production is disaggregated to services and construction. The dual flexprice–fixprice approach of Taylor (1983), distinguishing between agriculture and the rest of the economy, is taken into account with a specific food agriculture sector. Our formulation is different from Taylor's since both food agriculture and most non-agricultural outputs are supply-driven in the Zimbabwean context.

The sectors are disaggregated into the following categories: food agriculture, non-traded consumer goods ('services'), non-tradable capital goods ('construction'), exportables, and importables. The supply side of the import-dependent sectors construction, importables, and exportables captures the role of import regulation. The formulation allows for substitution possibilities in a hierarchical system including imported and domestic intermediates, skilled and unskilled labour and real capital. The exportables sector is a price-taker in world markets, and output and exports adjust to clear the market. In the construction sector, a falling demand curve combined with the rising supply curve equilibrate supply and demand. The same is the case for the importables sector because of imperfect substitution between domestic and imported importables goods. A combination of imports and domestic production equilibrate supply and demand for the composite good. With imperfect substitution, there is room for endogenous determination of the domestic price. The importables sector has some of the characteristics of a non-traded sector. Output of food agriculture is exogenous in the short run. Foreign trade in food is regulated and the domestic price clears the market. The service sector is characterised by mark-up pricing and demand-determined output.

A separation is made between skilled and unskilled labour in formulating both production and distribution technologies. In the labour market, skilled labour is in short supply, and the wage rate adjusts to clear the market. Unskilled labour is in permanent excess supply, and the use of unskilled labour is demand-determined, given an institutionally-determined nominal wage rate. In addition to skilled and unskilled labour, income is distributed to profit-earners and small-scale agriculturalists. The income groups have different savings rates, implying that income distribution affects aggregate demand in standard structuralist fashion.

The foreign exchange available—export revenues and an exogenous trade deficit—is allocated to satisfy priority needs (investment goods, intermediates for the exportables sector and food). The importables sector is protected, and only a limited volume of importables is allowed. Any remaining foreign exchange is allocated as policy-determined shares, to meet requirements for imported intermediates by construction and importables, and to non-competitive consumer imports. When imported intermediates are rationed in the construction and importables sectors, these sectors are forced to substitute towards domestic goods, resulting in an inefficient mix of inputs. The availability of imported intermediates, dependent on the existing capacity to import, influences the supply curves. The description is consistent with Davies (1991) and Pakkiri and Moyo (1986). A theoretical framework for analysing import compression is suggestion by Rattsø (1994A), with additional aspects developed by Rattsø (1994B) and Torvik (1994, 1997). Gibson (1985) was the first to link up export performance and import-dependent industries in a model of Nicaragua.

The imports of food are part of government policy to regulate domestic food markets, in particular in response to drought. We have made food imports endogenously dependent on food shortages, the gap between a target for food consumption and actual consumption. Investment imports are assumed to have priority. The investment level is fixed exogenously, and the import share responds to relative prices. The formulation reflects

the problem of identifying a well-defined investment function (see Mehlum and Rattso, 1993; Chhibber *et al.*, 1989), and the understanding that investment demand has been restricted by political and business uncertainty (see Dailami and Walton, 1989).

Based on this model of import regulation, trade liberalisation can be analysed as a regime shift, basically as explained in Figure 1. Davies *et al.* (1998) document the alternative model regimes and offer *ex ante* liberalisation experiments using the model. The change of adjustment mechanisms under liberalisation is our key concern. The first phase, intermediate liberalisation, does away with the rationing of intermediate imports, but keeps protectionism on food, importables and non-competitive consumer goods. The intermediate import demand functions of the construction and importables sectors are now unconstrained. The trade balance is endogenous, responding to changes in exports and imports, and foreign financing of the deficit is assumed available. Full liberalisation adds free trade in importables, non-competitive consumer goods and food. The agricultural price is given by the world market and net exports of food clear the domestic market.

To predict the consequences of trade liberalisation, we must know how the economic agents were rationed relative to their desired demand. Unfortunately, the degree of rationing cannot be observed, and assumptions must be made. The desired demand relevant for the liberalisation of imported intermediates depends on the substitution between domestic and imported importables. In our calibration, reflecting the rigid production structure of the economy, the pure substitution effect implies that about 90% of the demand for intermediate imports by construction and importables is satisfied. Sensitivity analyses are reported below. Under full liberalisation, the net effect on domestic demand is dependent on the desired switching to foreign consumer goods and the adjustment in private savings rates. It is assumed that actual final goods imports satisfy only one-third of desired demand in the base year. Savings rates are set to reproduce the actual development with liberalisation and drought, as explained in section 6.

### 5. Phase 1, 1990–91: intermediate liberalisation

The first step in the liberalisation process was to do away with the rationing of intermediates by setting raw materials and inputs on a OGIL list. Access to imported intermediates was seen as the main growth constraint. Liberalisation allowed imported intermediates to replace less suitable domestic ones, reducing marginal costs, and increasing output supply. An overall expansion of the economy was expected. This first phase of liberalisation largely took place during 1991. Our counterfactual model experiment assuming away intermediate rationing is compared with actual economic development in 1990–91. Table 2 reports the model results presented as deviations from the import-rationed benchmark, and can be compared with Table 1.

The import rationing captured in the benchmark model version imposes a supply constraint on the economy. When the firms cannot import the intermediates they desire, they are forced to apply an inefficient mix of domestic and imported intermediates, the unit costs are higher and outputs are lower than in a non-rationed situation. The reduced costs associated with a more efficient mix of intermediates lead to a relative price fall and expenditure switching away from other goods. The lower costs of domestic goods imply substitution to higher domestic content of investment goods, also stimulating domestic demand. The intermediate imports-constrained importables and construction sectors are expected to be the main sources of expansion. The overall output effect will be limited

Table 2. *Intermediate liberalisation*

	Phase 1 1990-91
GDP	+1.6
GDP services	+0.4
GDP construction	+3.5
GDP exportables	+1.1
GDP importables	+6.6
Private consumption	+4.2
Current account deficit, % of GDP	2.8

*Note:* Model simulation of intermediate liberalisation. All numbers are percentage changes from the base-year, except current account deficit.

when food output is assumed exogenously given and the export sector is not offered new incentives. The model predicts the partial effect of intermediate liberalisation to increase GDP by about 1.5%, by expanding importables and construction in the order of 3.5%–7%.

At this stage, we do not have data available to isolate trend effects from liberalisation in the actual development. The actual GDP growth of 4.5% is about 2% above the recent trend. It seems to us that the assumed degree of intermediate rationing, about 90% of that desired from a pure substitution effect, is reasonably realistic. If only 85% of that desired has been satisfied during rationing, the partial GDP rise is predicted to be above 2%.

At the sectoral level, the model predictions for importables, the dominating manufacturing sector of the model, can be compared to the index of manufacturing output shown in Table 1. The index shows a rise in manufacturing production during 1991 of about 3%, well below the partial expansion of importables suggested by the model experiment. Manufacturing industries have not performed as the liberated sector expected. Actual growth has been concentrated in services, and the manufacturing sector share of GDP in fact was reduced. Davies *et al.* (1994) address the combination of high growth of services during a period of stagnating private consumption. This is a puzzle since most of the demand for services is based on private consumption. Service production and private consumption should move in tandem.

All in all, intermediate liberalisation seems to have had limited effects on the economic results. By extension this may also suggest that the previous rationing cannot explain the growth stagnation during the 1980s, contrary to the understanding of most observers. Our interpretation of the limited short-run response is that firms have adjusted to the rationed conditions. Those that were unable to do so, did not survive. The economy had already rearranged itself to minimise the consequences of rationing. While one would expect such a selection process to operate in any rationed economy, in Zimbabwe it was probably reinforced by various export incentive schemes which had been introduced as early as 1983. These provided a channel for firms to reduce the constraint on their access to intermediate imports for domestic production. It follows that even if the short-run response to intermediate import liberalisation is small, rationing over time can be an important factor in explaining stagnation. Intermediate liberalisation was implemented with no new incentives for exports, and nominal devaluation was postponed. Slow export

response and a trade deficit consequently was to be expected. In the model, lower domestic costs of importables and construction reduce the relative price of composite intermediates for the exportables sector, and its value added rises by about 1%. Actual total exports were reduced by 3–4% during 1990–91 (in foreign currency). The model predicts that the partial effect of intermediate liberalisation worsens the trade deficit by about 3% of GDP. The actual trade deficit increased by about 6% of GDP from 1990 to 1991. Some of the expansion of the trade deficit is explained by GDP growth.

## 6. Phase 2, 1991–92: full liberalisation

The extension of the OGIL list to include final goods, the broadening of the export retention scheme, and the development of internal trade with export retention goods in the autumn of 1991 dramatically changed the conditions in domestic markets. In the annual data of the official statistics, 1992 represents the first year of major liberalisation of final goods. We assume that 'full' liberalisation starts in 1992. Unfortunately for Zimbabwe and for the analysis, during this important period the country also experienced a most serious drought. Our strategy to isolate the effect of liberalisation is a two-step analysis: first, a model simulation is constructed where the liberalisation measures are combined with the actual 24.4% drop in agricultural food value added. The model is calibrated to reproduce the drop of GDP of about 6.2%. The actual development for 1991–92 is compared to the economic effects predicted from intermediate to full liberalisation. Second, the model experiment is rerun without the drought, to compare intermediate and full liberalisation under 'normal' conditions.

When finished goods are added to trade liberalisation, four implications of previous rationing are modified. First, the protected importables sector faces competition from abroad. In the benchmark rationed situation, the sector is treated as non-traded with exogenous imports and domestically determined prices. Now, imperfect substitution is assumed between domestically produced and imported importables, and the composite is a CES aggregate. It follows that output supply can respond to cost and price conditions with a combination of domestic production and imports. Second, non-competitive consumer imports come in. The demand function for non-competitive consumption goods allocates consumer spending between domestic and foreign goods, and liberalisation allows more of a given demand to be directed towards imported goods. Third, the new access to imported goods is assumed to reduce private savings rates, inducing higher consumer demand, given the income level. Fourth, trade in food is assumed to be determined by market forces. The flexible food price implied by import controls is replaced by one fixed by the world market. Imports and exports of food vary to clear the domestic market, rather than its price.

This more ambitious liberalisation has the same expansionary effects as the more limited first phase: lower costs of the composite intermediate and higher domestic content of investment goods. In addition, reduced savings rates mean more consumer demand out of a given income. Since no consumption and savings data are available, the savings rates are calibrated to reproduce the GDP fall with drought. The private savings rates must be assumed to fall by about 15 percentage points on average. The changing domestic markets imply that countervailing contractionary effects are also in action. The opening-up of the market for importables crowds domestic producers out of the market. The old protection was efficient. The access to non-competitive consumer imports switches demand from domestically produced goods.

The model predicts that the combination of liberalisation and drought was output-contractory, but consumption-expansionary. Trade liberalisation implies expenditure switching from domestic to foreign goods, adding contraction to the drought. Expenditure switching from the future to the present when final goods imports are available explains the consumption boom. The model expects the main contraction to affect importables, about 8% (shown in Table 3 as a percentage deviation from the simulated phase 1 liberalisation). The manufacturing index reported in Table 1 indicates a drop in manufacturing output of 9.1% from 1991 to 1992. The Economic Intelligence Unit (EIU) country report on Zimbabwe (4th quarter 1994, p. 5) operates with a fall in manufacturing production of 7.5%.

While aggregate demand goes up, reduced savings rates dominate the income fall, and the net effect on domestic demand is negative. A private consumption boom of close to 6% is expected even with the serious drought, but no national accounts data are available for comparison. The reduced domestic demand explains the predicted fall in services value added of about 2.5%. The EIU country report operates with a similar reduction of services, 2.6%, from 1991 to 1992. The decrease in domestic demand produces a real exchange rate depreciation and some expansion of exportables in the model. Exports fall basically related to agricultural markets and drought. Actual exports dropped by 10% (in foreign currency, Table 1).

Not surprisingly, the combination of drought, domestic contraction, import liberalisation, and increased consumption has a major impact on the trade balance. The model predicts a rise in the deficit of more than 10% of GDP, the combined result of agricultural market balancing and private consumption boom. The actual trade deficit rose to 13.6% in 1992.

No doubt liberalisation and drought imply economic contraction, deindustrialisation and foreign deficit. The difficulty is in disentangling the effects of the drought from those of trade liberalisation. In the model, we assume that the 1992 drought did not take place and that the drop in savings rates calibrated fully represents a trade liberalisation effect. Bevan *et al.* (1990) argue that there are reasons to observe a fall in savings rates when the economy is hit by drought. Drought pushes income below average, and consumers respond by decreasing savings rates to smooth consumption. Our approach is based on three arguments. First, we expected a strong savings effect due to the long period of suppressed consumption before liberalisation took place. Second, data from the 1987 drought indicate that no significant reduction of private savings rates took place, as analysed by Davies *et al.* (1994, Table 2). Third, by assuming that all of the fall in savings rates is explained by liberalisation, we are implicitly very optimistic about the expansionary forces of phase 2 of liberalisation. Our simulation can thus be interpreted as the most favourable expansionary effect of trade liberalisation.

Table 3 shows that liberalisation without drought is contractionary, even with the assumed drop in savings rates. GDP drops by 0.7% when full and intermediate liberalisation are compared. Employment of unskilled workers falls by more than 1%. The expenditure-switching effects toward foreign goods are stronger than the expenditure-increasing effects of increased savings.

The contraction can be traced back to the importables sector, with a decrease in value added of 5.0%. The previously protected importables sector is a key player in the liberalisation process. In the old regime, both intermediate inputs and finished importable goods were rationed. In phase 1 the sector had free access to intermediates, and expanded. When protection was removed in phase 2, the loss of market share dominates

Table 3. Full liberalisation

	Phase 2 Liberalisation 1990-91	Phase 2 Liberalisation without drought	Phase 2 Liberalisation with devaluation
GDP	-6.3	-0.7	0.0
GDP services	-2.5	-0.5	+1.5
GDP construction	-0.7	-0.6	0.0
GDP exportables	+1.2	+0.4	+1.5
GDP importables	-7.8	-5.0	-4.6
Private consumption	+5.7	+13.2	+13.7
Current account deficit, % of GDP	+10.8	+8.8	+8.2

Note: Model simulation of full liberalisation. All numbers are percentage changes from intermediate liberalisation.

increased consumer demand. If Figure 1 is interpreted as the importables market, we end up with an inward shifting demand curve to equilibrium *d*.

The trade reform generated structural adjustment away from non-tradable and importable goods towards exportables. In the model, the fall in domestic demand depreciates the real exchange rate and stimulates the supply of exportables. But the expansion of exports is too slow to compensate for the loss of domestic market shares in the short run. Another way of looking at the foreign exchange consequences emphasises the consumption boom by more than 13%, hand in hand with the output contraction. The model predicts a rise in the trade deficit of about 9% as a result of liberalisation only. Even without the drought, the simulated deficit is comparable to the first years of independence, when it went up to about 10% of GDP (Davies *et al.*, 1994, Table 2). A deficit of this magnitude is hardly sustainable. The deficit and the deindustrialisation associated with it are the high short-run price of liberalisation, even if the long-run effects may be favourable.

Furthermore, short-run deindustrialisation may induce unfavourable long-run effects. If there are external economies of scale in the manufacturing sector, short-run deindustrialisation moves the economy to a development path with lower growth of potential output.

As pointed out by Collier and Gunning (1992), trade liberalisation on its own may be incompatible. When private agents observe the large effect on the trade balance, they will expect future devaluations. Hence, imports are temporarily cheap, worsening the trade balance further, and making liberalisation even less sustainable. With this background, it is not hard to understand the hoarding of imports that took place during 1992.

## 7. Counterfactual devaluation

The above results explain why trade liberalisation is usually accompanied by devaluation. A devaluation may counteract the sustainability problem and the politically unacceptable contractionary consequences of liberalisation. The Zimbabwean government was criticised for devaluing too little too late before the exchange rate float in 1993. We can analyse some of the devaluation potential in a counterfactual model experiment. The actual situation faced by the government was to counteract the combined effects of drought and liberalisation. According to the model, a nominal devaluation of more than

60% was necessary to prevent output from falling from 1991 to 1992. Devaluation is expansionary, basically by reducing the real wage of unskilled labour. Since such a devaluation is unrealistically high, we concentrate the numerical presentation in Table 3 on the nominal devaluation needed to preserve output without drought, about 4%. This can be interpreted as the minimum devaluation necessary when the entire drop in private savings rates is assumed to result from liberalisation.

Liberalisation with devaluation can help avoid contraction by stimulating the exportables sector, but also by limiting the output reduction in the importables sector. Improved competitiveness towards imported goods is still more than offset by loss of market shares. The devaluation implies a fall in the relative price of domestic to imported investment goods, and the construction sector responds (compared to no devaluation in Table 3). The small devaluation helps reduce the trade deficit, but the foreign exchange problem of the reform is still present.

Given the unlucky coincidence of the liberalisation process with drought, the devaluation needed to keep output constant would be very high. The consequence would be a dramatic decline in real wages for unskilled workers. Since virtual prices are higher than actual ones under rationing, their utility level is not necessarily reduced equivalently. But if compensation is demanded, the required nominal devaluation is even higher, and the economy may easily be thrown into accelerating inflation by trade liberalisation. Our interpretation of a big devaluation is that it solves some problems of the liberalisation package and the drought by creating new ones. Balancing the two is a delicate political challenge. Given the sharp contraction and accelerating foreign debt, we are not convinced that the challenge has been met.

## **8. Concluding remarks**

Rodrik (1994) has formulated the question many analysts have been occupied with concerning trade liberalisation: 'If reform is such a great idea, why are governments typically so reluctant to undertake it?' The Zimbabwean experience has given part of the answer. Short-run adjustment problems are to be expected. The consequences for both industrial structure and macroeconomic balance should worry observers.

Trade liberalisation is meant to improve the efficiency of the economy by having imports substitute domestic import-competing industries and by stimulating exports. The reduction of import-competing activities is typically faster than the rise of new export activities, and short-run output contraction and unemployment are to be expected. In Zimbabwe, this output contraction is associated with deindustrialisation, which may also have unfavourable growth effects. It should be noticed that deindustrialisation results in our analysis even when the investment level is assumed constant. The uncertainty created by liberalisation may well reduce investment and contribute to further deindustrialisation. No data are available to evaluate the investment response, and such responses are hard to build into standard behavioural functions in CGE models.

The deindustrialisation in Zimbabwe may be particularly strong because of its historical background. The international sanctions during the UDI-period led to a broad manufacturing base, but also to more inward-looking industries than in most countries. The import rationing of intermediates using quotas implied a static manufacturing production sector. The concern now is that the comparative advantages are hardly related to advanced manufacturing production. Zimbabwe may end up as more raw-material oriented, with expansion of exports in agriculture, horticulture and mining. Given the fall

in real wages, it is somewhat surprising and worrying that manufacturing exports have not responded more.

The future development of the real side depends on the adjustment capacity of industries to the new conditions, the movements in the interest rate and the exchange rate, and the responses of investors at home and abroad. An optimistic scenario implies a strong rise in export revenues related to mining and an inflow of foreign investment, thereby modernising the economy. A pessimistic scenario would follow continued high real interest rates, exchange rate appreciation and policy uncertainty discouraging foreign investment. Which ever scenario, it is hard to see any broad-based employment creation and income redistribution in the near future.

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## Appendix: Documentation of the Zimbabwe model

The essentials of the model are presented here, while the full documentation of the benchmark model is available in Rattsø and Torvik (1992). The equation set and the full list of symbols are shown below. The supply side of the model is described by equations (2) to (25) and is brought together with the demand side by the market-clearing equation (1). The output of agriculture, sector 1, is exogenously given by capacity (equation (2)) and a flexible price level arranges the market clearing. Services, sector 2, are assumed to be demand determined with mark-up pricing (equation (3)).

In the three other sectors, production functions include skilled and unskilled labour, domestic and imported intermediates and real capital. They are specified as multi-level CES and Leontief functions. For each sector, output  $X$  is produced by a value-added aggregate and an intermediate goods aggregate,  $N$ , in fixed proportions. The value added is a CES function of capital stock,  $K$ , and a labour aggregate,  $L$ , (shown by the term in parentheses in equation (4)). The capital stock is historically given. Labour is a CES aggregate of unskilled  $L_u$  and skilled labour  $L_s$ . Intermediate goods,  $N$ , are a CES aggregate of imported intermediates,  $II$ , and domestic intermediates,  $DI$ . Domestically produced intermediate goods are linked to aggregate  $DI$  by fixed coefficients.

The allocation of intermediate imports is a key aspect of the supply-side adjustment. Exportables (sector 4) are assumed to have priority, so that their demand for imported intermediates is satisfied (equation (6)). However, construction (sector 3) and importables (sector 5) are both import-dependent and rationed. They are assumed to consume whatever quantity of imported intermediates they are given through the allocation system. The rationed imported intermediates feed into the CES-aggregate for intermediate goods (equation (8)).

Prices in the three sectors are set equal to marginal costs (equation (9)), and the marginal costs are the weighted sum of the marginal costs of intermediates and value added (equation (10)).

The exportables sector is a price-taker in the world market (equation (11)). Since the sector is not rationed, the marginal cost of its intermediate goods' aggregate is the price of the aggregate (equation (12)). The marginal cost of the value-added aggregate is derived from the value-added production function in the normal way (equation (13)). Export volume is determined as a residual, given the supply function and the domestic demand for exportables.

The use of domestic intermediates in the rationed sectors is determined by standard cost-minimising conditions. The part of the marginal cost associated with intermediates is influenced by the rationing of imported intermediates (equation (14)). Equations (15)–(20) define costs and input–output coefficients, while the labour market is described by equations (21)–(25). This combines a fixed-wage, demand-determined unskilled labour market and a full employment, wage-clearing, skilled labour market. Unit labour costs are determined as a CES aggregate, and substitution between the two skill types follows from varying demand for skilled workers.

The income generation and consumption demand aspects of the model capture distributional effects and rationing of imported consumer goods (equations (26)–(34)). The four income groups defined above have different propensities to save, an imported aspect of overall savings formation. Savings rates are influenced by access to non-competitive imported consumer goods (equation (31)). The level of imports that consumers desire is determined as a constant fraction of net consumer expenditures (equation (32)). However, rationing of consumer imports means that these desires cannot be fulfilled, leading to postponed consumption and increased demand for domestic consumer goods.

Equations (35)–(37) model public-sector accounting. Equations (38)–(41) handle foreign-exchange rationing. The outlays for competitive imports, investment goods and priority intermediate imports to exportables are subtracted from the sources of foreign exchange to determine the rationed amount (assumed to be positive) (equation (38)). This is then allocated between imports of agricultural goods (39), imported intermediates for construction and importables (40) and imported non-competitive consumer goods (41). The specification implies priority of imported food over intermediates and consumption goods; food imports are related to a target  $C_1^*$  for food consumption.

Investment is assumed to be a CES aggregate of sector 3, sector 5 and imported investment goods. The composition of the investment aggregate is made dependent on relative prices as in (42) and (43). The price of the investment aggregate follows in (44). Finally, equation (45) is a consistency check of the investment–savings balance.

### A1. The benchmark rationing model

$$X_i = \sum_{j=1}^5 a_{ij} \cdot X_j + C_i + G_i + J_i + E_i - M_i + DS_i \quad (i = 1-5) \quad (1)$$

$$X_1 = XB_1 \quad (2)$$

$$P_2 = \frac{(1 + \iota_2)(1 + \tau_2)}{1 - (1 + \iota_2)(1 + \tau_2) a_{22}} [a_{12} \cdot P_1 + a_{32} \cdot P_3 + a_{42} \cdot P_4 + a_{52} \cdot P_5 + q_2 \cdot b_2] \quad (3)$$

$$X_i = \frac{1}{1 - n_i} \left( [\mu_{1i} \cdot L_i^{-\frac{1-n_i}{n_i}} + \mu_{2i} \cdot K_i^{-\frac{1-n_i}{n_i}}]^{-\frac{n_i}{1-n_i}} \right) \quad (i = 3-5) \quad (4)$$

$$N_i = n_i \cdot X_i \quad (i = 3-5) \quad (5)$$

$$II_4 = \epsilon_{14} \delta_4 \left( \frac{e \cdot P_{04}}{MC_{N4}} \right)^{-\delta_4} N_4 \quad (6)$$

$$DI_4 = \epsilon_{24} \delta_4 \left( \frac{P_{DI4}}{MC_{N4}} \right)^{-\delta_4} N_4 \quad (7)$$

$$N_i = \left[ \epsilon_{1i} \cdot II_i^{-\frac{1-\delta_i}{\delta_i}} + \epsilon_{2i} \cdot DI_i^{-\frac{1-\delta_i}{\delta_i}} \right]^{-\frac{\delta_i}{1-\delta_i}} \quad (i = 3,5) \quad (8)$$

$$P_i = MC_i \quad (i = 3-5) \quad (9)$$

$$MC_i = n_i \cdot MC_{Ni} + (1 - n_i)MC_{VAi} \quad (i = 3-5) \quad (10)$$

$$P_4 = e \cdot P_4^* \quad (11)$$

$$MC_{N4} = [\epsilon_{14}(e \cdot P_{04}^*)^{1-\delta_4} + \epsilon_{24} \cdot P_{D14}^{\delta_4}]^{\frac{1}{1-\delta_4}} \quad (12)$$

$$MC_{VAi} = \frac{q_i}{\mu_{1i}} \left[ \mu_{1i} \cdot L_i^{-\frac{1-\eta_b}{\eta_b}} + \mu_{2i} \cdot K_i^{-\frac{1-\eta_b}{\eta_b}} \right]^{\frac{1}{1-\eta_b}} \cdot L_i^{\frac{1}{\eta_b}} \quad (i = 3-5) \quad (13)$$

$$MC_{Ni} = \frac{P_{Di}}{\epsilon_{2i}} \left[ \epsilon_{1i} \cdot II_i^{-\frac{1-\delta_i}{\delta_i}} + \epsilon_{2i} \cdot DI_i^{-\frac{1-\delta_i}{\delta_i}} \right]^{\frac{1}{1-\delta_i}} \cdot DI_i^{\frac{1}{\delta_i}} \quad (i = 3,5) \quad (14)$$

$$P_{Dj} = \sum_{i=1}^5 f_{ij} \cdot P_i \quad (j = 3-5) \quad (15)$$

$$B_j = \sum_{i=1}^5 a_{ij} \cdot P_i + a_{0j} \cdot e \cdot P_{0j} + q_j \cdot b_j \quad (j = 2-5) \quad (16)$$

$$A_{ij} = f_{ij} \cdot DI_j \quad (i = 1-5, j = 3-5) \quad (17)$$

$$a_{0j} = \frac{II_j}{X_j} \quad (j = 3-5) \quad (18)$$

$$a_{ij} = \frac{A_{ij}}{X_j} \quad (i = 1-5, j = 3-5) \quad (19)$$

$$L_i = b_i \cdot X_i \quad (i = 2-5) \quad (20)$$

$$q_i = \left[ \alpha_i \cdot w_{ii}^{\sigma_i} \cdot L_i^{1-\sigma_i} + \beta_i \cdot w_i^{\sigma_i} \cdot L_i^{1-\sigma_i} \right]^{\frac{1}{1-\sigma_i}} \quad (i = 2-5) \quad (21)$$

$$L_{ii} = \alpha_i \cdot q_i^{\sigma_i} \left( \frac{w_{ii}}{q_i} \right)^{-\sigma_i} L_i \quad (i = 2-5) \quad (22)$$

$$L_{ii} = \beta_i \cdot q_i^{\sigma_i} \left( \frac{w_i}{q_i} \right)^{-\sigma_i} L_i \quad (i = 2-5) \quad (23)$$

$$L_u = \sum_{i=2}^5 L_{ii} + L_{ug} \quad (24)$$

$$L_s = \sum_{i=2}^5 L_{si} + L_{sg} \quad (25)$$

$$Y_a = P_1 \cdot X_1 \quad (26)$$

$$Y_u = \sum_{i=2}^5 w_{ii} \cdot L_{ii} + w_{ug} \cdot L_{ug} \quad (27)$$

$$Y_t = \sum_{i=2}^5 w_i \cdot L_{si} + w_i \cdot L_{ig} + NFPA \quad (28)$$

$$Y_x = \sum_{i=2}^5 P_i \cdot X_i - B_i \cdot X_i - \frac{t_i}{1+t_i} P_i \cdot X_i \quad (29)$$

$$D = (1-s_a)Y_a + (1-s_u)Y_u + (1-s_z)Y_z + (1-s_x)(1-t_x)Y_x \quad (30)$$

$$s_j = s_j^* + \gamma_j \left( \frac{CIMP_D - CIMP_A}{CIMP_D} \right)^2 \quad (j = a, u, s, z) \quad (31)$$

$$CIMP_D = \frac{m_c}{e \cdot P_{OC}^*} (D - DB) \quad (32)$$

$$DB = \sum_{i=1}^5 P_i \cdot \theta_i \quad (33)$$

$$C_i = \theta_i + \frac{m_i}{(1-m_i)P_i} (D - DB - e \cdot P_{OC}^* \cdot CIMP_A) \quad (i = 1-5) \quad (34)$$

$$GREV = t_x \cdot Y_x + T^{IND} \quad (35)$$

$$T^{IND} = \sum_{i=1}^5 \frac{t_i}{1+t_i} P_i \cdot X_i \quad (36)$$

$$GEXP = \sum_{i=1}^5 P_i \cdot G_i + w_{ug} \cdot L_{ug} + w_i \cdot L_{ig} - (P_1 - e \cdot P_1^*)M_1 - (P_5 - e \cdot P_5^*)M_5 \quad (37)$$

$$RAT = -e \cdot P_5^* \cdot M_5 - e \cdot P_{0y}^* \cdot J_0 - e \cdot P_{04}^* \cdot II_4 + DEF + P_2 \cdot E_2 + P_4 \cdot E_4 + NFPA \quad (38)$$

$$M_1 = M_1^* + h_{01} \cdot (C_1^* - C_1) \quad (39)$$

$$II_i = II_i^* + h_{0i} \cdot \frac{(RAT - e \cdot P_{03}^* \cdot II_3^* - e \cdot P_{05}^* \cdot II_5^* - e \cdot P_1^* \cdot M_1)}{e \cdot P_{0i}^*} \quad (i = 3, 5) \quad (40)$$

$$CIMP_A = h_{0C} \cdot \frac{(RAT - e \cdot P_{03}^* \cdot II_3^* - e \cdot P_{05}^* \cdot II_5^* - e \cdot P_1^* \cdot M_1)}{e \cdot P_{OC}^*} \quad (41)$$

$$J_i = \pi_i \Gamma \left( \frac{P_i}{P_y^{COMP}} \right)^{-\Gamma} J \quad (i = 3, 5) \quad (42)$$

$$J_0 = \pi_0 \Gamma \left( \frac{e \cdot P_{0i}^*}{P_y^{COMP}} \right)^{-\Gamma} J \quad (43)$$

$$P_y^{COMP} = [\pi_0^\Gamma \cdot (e \cdot P_{0y}^*)^{1-\Gamma} + \pi_3^\Gamma \cdot P_3^{1-\Gamma} + \pi_5^\Gamma \cdot P_5^{1-\Gamma}]^{\frac{1}{1-\Gamma}} \quad (44)$$

$$P_3 \cdot \mathcal{J}_3 + P_5 \cdot \mathcal{J}_5 + e \cdot P_{0j}^* \cdot \mathcal{J}_0 + \sum_{i=1}^5 P_i \cdot DS_i = s_a \cdot Y_a + s_u \cdot Y_u + s_s \cdot Y_s + s_z(1 - t_z)Y_z + GREV - GEXP + DEF \quad (45)$$

*Definition of variables*

*Endogenous variables*

The model consists of 117 equations. Of these, 116 are independent since the investment-savings balance can be calculated from the rest of the equations. We therefore have the following 116 endogenous variables:

- $A_{ij}$  - intermediate deliveries,  $i = 1 - 5, j = 3 - 5$
- $a_{oj}$  - intermediate imports-output coefficients sectors,  $j = 3 - 5$
- $a_{ij}$  - intermediate input-output coefficients sectors,  $j = 3 - 5, i = 1 - 5$
- $B_i$  - variable costs pr. unit of output sectors,  $i = 2 - 5$
- $b_i$  - labour-output coefficients sectors,  $i = 3 - 5$
- $C$  - private consumption,  $i = 1 - 5$
- $CIMP_D$  - desired non-competitive consumer imports
- $CIMP_A$  - actual non-competitive consumer imports
- $D$  - consumer spending
- $DB$  - spending for floor consumption
- $DI_i$  - domestic intermediate goods aggregate sectors = 3 - 5
- $E_4$  - exports, sector 4
- $GEXP$  - government expenditure
- $GREV$  - government revenue
- $II_i$  - intermediate imports sectors,  $i = 3 - 5$
- $\mathcal{J}_i$  - investment deliveries from sectors  $i = 0, 3, 5$
- $L_{un}$  - unskilled workers sectors  $i = 2 - 5$
- $L_{si}$  - skilled workers sectors,  $i = 2 - 5$
- $L_u$  - total unskilled workers
- $L_i$  - labour aggregates sectors,  $i = 2 - 5$
- $M_1$  - imports of agricultural goods
- $MC_i$  - marginal cost sectors,  $i = 3 - 5$
- $MC_{Ni}$  - marginal cost of intermediate goods aggregate sectors,  $i = 3 - 5$
- $MC_{VAi}$  - marginal cost of value-added aggregate sectors,  $i = 3 - 5$
- $N_i$  - intermediate goods aggregate sectors,  $i = 3 - 5$
- $P_i$  - sectoral price levels,  $i = 1 - 5$
- $P_{Dij}$  - price of domestic intermediate goods aggregate sectors,  $i = 3 - 5$
- $P_j^{COMP}$  - price of investment aggregate
- $q_i$  - labor costs sectors,  $i = 2 - 5$
- $RAT$  - foreign exchange available for rationed goods
- $s_i$  - savings rates,  $i = a, u, s, z$
- $T^{IND}$  - indirect taxes
- $w_s$  - wage rate, skilled workers
- $X_i$  - sectoral output levels,  $i = 1 - 5$
- $Y_a$  - agricultural income
- $Y_s$  - wage income, skilled workers
- $Y_u$  - wage income, unskilled workers
- $Y_z$  - profit income

*Parameters*

- $a_{ij}$  - intermediate input-output coefficients sectors,  $j = 1 - 2, i = 1 - 5$
- $b_2$  - labour - output coefficient sector 2
- $C_1^*$  - target on food consumption
- $f_{ij}$  - shares in domestic input aggregate sectors,  $j = 3 - 5, i = 1 - 5$

- $h_{0i}$  – rationing parameters,  $i = 1, 3, 5, C$   
 $II_i$  – minimum level of imported intermediates sectors,  $i = 3, 5$   
 $M_1^*$  – constant in agricultural imports function  
 $m_c$  – propensity to consume non-competitive imports  
 $m_i$  – marginal propensity to consume,  $i = 1 - 5$   
 $n_i$  – intermediate goods–output ratio sectors,  $i = 3 - 5$   
 $s_i^*$  – constant in savings functions,  $i = a, u, s, z$   
 $t_i$  – indirect tax rates sectors,  $i = 1 - 5$   
 $t_p$  – tax rate of profit income  
 $\alpha_i$  – distribution parameter of unskilled labour in CES aggregate sectors,  $i = 2 - 5$   
 $\beta_i$  – distribution parameter of skilled labour in CES aggregate sectors,  $i = 2 - 5$   
 $\gamma_i$  – savings response parameter,  $i = a, u, s, z$   
 $\Gamma$  – elasticity of substitution in investment aggregate  
 $\delta_i$  – elasticity of substitution in intermediate goods aggregate sectors,  $i = 3 - 5$   
 $\epsilon_{1i}$  – distribution parameter of intermediate imports in intermediate goods aggregate sectors,  $i = 3 - 5$   
 $\epsilon_{2i}$  – distribution parameter of domestic intermediates in intermediate goods aggregate sectors,  $i = 3 - 5$   
 $\eta_i$  – elasticity of substitution in value-added aggregate sectors,  $i = 3 - 5$   
 $\theta_i$  – floor consumption levels,  $i = 1 - 5$   
 $\mu_{1i}$  – distribution parameter of labour in value-added aggregate sectors,  $i = 3 - 5$   
 $\mu_{2i}$  – distribution parameter of capital in value-added aggregate sectors,  $i = 3 - 5$   
 $\pi_i$  – distribution parameter of sectoral goods in investment aggregate,  $i = 0, 3, 5$   
 $\sigma_i$  – elasticity of substitution in labour aggregate sectors,  $i = 2 - 5$   
 $\tau_2$  – mark-up rate sector 2

#### Exogenous variables

- $DS_i$  – changes in stocks,  $i = 1 - 5$   
 $DEF$  – trade deficit  
 $E_2$  – exports sector 2  
 $e$  – exchange rate  
 $G_i$  – government consumption,  $i = 1 - 5$   
 $\mathcal{J}$  – investment aggregate  
 $K_i$  – capital in sectors,  $i = 3 - 5$   
 $L_i$  – supply of skilled labour  
 $L_{ug}, L_{sg}$  – government employment  
 $M_5$  – competitive imports sector 5, goods  
 $NFPA$  – net factor payments from abroad  
 $P_i^*$  – foreign price of sectoral goods,  $i = 1, 4, 5$   
 $P_{0c}^*$  – foreign price of non-competitive consumer imports  
 $P_{0i}^*$  – foreign price of intermediate imports to sectors,  $i = 3 - 5$   
 $P_{0j}^*$  – foreign price of investment goods  
 $W_w, W_{ug}$  – wage rates, unskilled workers,  $i = 2 - 5$   
 $XB_1$  – output level sector 1

## A2. The phase 1 liberalisation model

In the phase 1 liberalisation model, the rationing of imported intermediates is removed, and intermediate demand functions for sectors 3 and 5 operate as for the initially unrationed exports sector 4. The rationing rule (40) is eliminated, and the demand is determined as in equation (6). The demand for domestically-produced intermediates is determined as in equation (7), and equation (8) can be eliminated. The rationed marginal cost functions (14) are replaced by (12). Food and non-competitive consumer imports are still rationed, and  $M_1$  and  $CIMP_A$  are exogenous, while the rationing rules (39) and (41) are eliminated. The trade deficit is endogenous, and follows from the revised equation (38)

$$DEF = e \cdot P_1^* \cdot M_1 + e \cdot P_5^* \cdot M_5 + e \cdot P_{03}^* \cdot II_3 + e \cdot P_{04}^* \cdot II_4 + e \cdot P_{05}^* \cdot II_5 + e \cdot P_{0c}^* \cdot CIMP_A + e \cdot P_{0j}^* \cdot \mathcal{J}_0 - P_2 \cdot E_2 - P_4 \cdot E_4 - NFPA$$

### A3. The phase 2 liberalisation model

In this version, we eliminate the protection from imported importables and non-competitive consumer goods. A composite importables good is introduced, a CES aggregate of domestically produced and imported importables. The demand for the composite is  $X_5^*$ , and the composition of the composite is determined by

$$X_5 = \xi_1 \left( \frac{P_5}{P_5^{Comp}} \right)^{-\psi} X_5^*$$

$$M_5 = \xi_2 \left( \frac{e \cdot P_5^*}{P_5^{Comp}} \right)^{-\psi} X_5^*$$

$$P_5^{Comp} = [\xi_1 \cdot P_5^{1-\psi} + \xi_2 \cdot (e \cdot P_5^*)^{1-\psi}]^{\frac{1}{1-\psi}}$$

where  $\xi_1$  and  $\xi_2$  are distribution parameters for domestically produced and imported goods in the CES aggregate,  $\psi$  is the elasticity of substitution, and  $P_5^{Comp}$  the price of the aggregate (replaces  $P_5$  in all demand functions). Equation (1) for sector 5 is now a market balance for the domestic components of demand only, and  $M_5$  is left out of the equation.

The liberalisation of non-competitive consumer goods in phase 2 implies that imports are determined by demand in equation (32) (where  $CIMP_D$  is replaced by  $CIMP_A$ ). The consumer demand functions (34) are reformulated to:

$$C_i = \theta_i + \frac{m_i}{P_i} (D - DB) \quad (i = 1 - 5)$$

Since the domestic market for food is also liberalised in phase 2, imports  $M_1$  are made endogenous and  $P_1$  is determined by the world price and the exchange rate. The market equilibration is changed from a flex-price regime to an import-adjusting regime in the standard open-economy fashion.

### A4. Calibration

The benchmark model is built around a social accounting matrix (SAM) for 1985 documented by Rattsø and Torvik (1992). All variables are calculated in millions of Zimbabwe dollar at 1985 prices. The parameters and the exogenous variables of the model are set to have the endogenous variables consistent with the SAM. The savings rates differ between economic groups ( $s_a = s_u = 0.22$ ,  $s_s = 0.27$ ,  $s_x = 0.5187$ ). The consumption demand parameters follow from assumptions about the income elasticities (0.8 for agriculture and 1.05 for services) and the supernumerary income ratio (0.48).

Other key parameter values used in the simulations are as follows:

Elasticities of substitution:

- in labour aggregate,  $\sigma_i = 0.5$ ,  $i = 2-5$
- in intermediate goods aggregate,  $\delta_i = 0.333$ ,  $i = 3-5$
- in value-added aggregate,  $\eta_i = 0.5$ ,  $i = 3, 5$  and  $0.2$ ,  $i = 4$
- in investment aggregate,  $\Gamma = 0.5$
- in sector 5, Armington aggregate,  $\Psi = 0.8$

Constants in savings functions,  $s^*_a = 0.22$ ,  $s^*_u = 0.10$ ,  $s^*_s = 0.15$ ,  $s^*_x = 0.32$

Savings response parameters,  $\gamma_a = 0$ ,  $\gamma_u = \gamma_s = 0.27$ ,  $\gamma_x = 0.4471$

Rationing parameters,  $h_{01} = 1$ ,  $h_{03} = 0.0535$ ,  $h_{05} = 0.3512$ ,  $h_{0c} = 0.5953$

Constant in food import function,  $M_1^* = 36$

Minimum levels of imported intermediates,  $I^*_3 = 90$ ,  $I^*_5 = 600$

To investigate the effects of liberalisation, the calibration must assume how consumers and producers were rationed. The results are based on the following assumptions:

The production functions determine the desired demand for imported intermediates. Small elasticities of substitution reflect the rigid production structure of the economy. The pure substitution effect of the rationing of intermediate imports assumes that about 91% of the demand

for intermediate imports by construction and importables is satisfied. Sensitivity analysis shows that if 95% of the demand for intermediate imports by the rationed sectors is satisfied initially, the economic expansion following phase 1 liberalisation is about 1 percentage point lower than in the experiment reported in Table 2.

Non-competitive consumer imports and imports of sector 5 goods are assumed to be strictly rationed, with the actual imports satisfying only one-third of actual demand. The parameters in the savings functions are then calibrated to reproduce the actual observed development for total GDP in phase 2 of the liberalisation. Private savings rates have to fall by about 12 percentage points for labour and by about 20 percentage points for profit to reproduce the actual development from 1991 to 1992. Even with this big drop in private savings, the demand switching dominates in phase 2, liberalisation without drought in Table 3.