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A CGE Analysis of the Short-run Welfare Effects of Tariff Liberalisation in Uganda

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Abstract

The promotion of human welfare is undoubtedly one of the greatest challenges of economic development. To achieve this, many developing countries adopted trade liberalisation in the late 1980s, premised on the theoretical evidence based on the definitive Heckscher-Ohlin theory which predicts gains for the poor. The empirical support for this theory, however, is at best mixed. This paper employs powerful Computable General Equilibrium techniques to data from Uganda, a typical Sub-Saharan Africa country largely recognized as a front-runner in trade liberalisation to investigate the short-run welfare impact of tariff liberalisation. It finds that trade liberalisation is no panacea to developing country problems. In fact, there are only minimal welfare gains largely accruing to the agricultural households. Furthermore, the importance of transfers (both government and inter-household) as well as exchange rate movements in determining differential welfare outcomes are highlighted.

Keywords: CGE modelling, tariff liberalisation, Uganda

JEL classification: D58, I30, O55

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1 Introduction

The promotion of human welfare is undoubtedly one of the greatest challenges of economic development. To this end, the last decade saw several developing countries embracing globalisation and in particular, significantly lowering barriers to trade, with the expectation of higher GDP growth rates (macro-level gains) predicted by the plethora of empirical work that demonstrates a positive causal link between trade liberalisation and growth.

At the household (micro) level, this promise of gains from trade liberalisation was premised on the definitive Heckscher-Ohlin theory that predicts gains for labour, the more abundant factor of production in developing countries, mainly supplied by the poor. Increasingly, however, the validity of this theory in a multi-dimensional context allowing for the possibility of factor reversals has been questioned.

The household is an important entity in the analysis of any welfare impact of trade liberalisation. There are several complex channels of influence of trade liberalisation on households and the ability to trace gainers and losers critically hinges on understanding the channels through which the effect is transmitted (McKay et al. 1999). Households are important first as consumers affected by changes in prices and availability of consumer goods, then as suppliers of factors of production, particularly labour, and lastly as producers in the agricultural and non agricultural sectors (McKay et al. 1999).

Uganda is a typical SSA country in several respects. It had a GDP per capita (PPP) of less than 1300 dollars in 2000 (World Bank 2002) and has an export sector that continues to be dominated by traditional cash crops. These accounted for 71.3 per cent of export earnings in 1999 with coffee contributing 60.1 per cent up from 55.1 per cent in 1998. Non-traditional exports are only recently gaining prominence. In 1999, gold and its compounds ranked first at 6.9 per cent of export earnings up from 3.6 per cent in 1998. This was closely followed by fish and fish products contributing 5.2 per cent.

It had two decades of political turmoil and economic implosion in the 1970s and 1980s, after which it embraced the Economic Recovery Program (ERP) in 1987 with a view to instituting market-oriented policy reforms including liberalisation of foreign exchange and achieving macro-economic stabilisation (Morrissey and Rudaheranwa 1998). It has since taken massive strides towards sustained trade liberalisation including the lowering of tariffs, the removal of the Coffee Marketing Board monopoly and the reduction of exemptions. In fact, it is now well recognised as a front-runner in trade liberalisation (Sachs and Warner 1997). However, contrary to poverty analyses which indicate a marked decline in poverty headcount from 56 per cent in 1992 to 35 per cent in 1999 (Appleton 2001), there have been concerns with whether the poor have benefited. This disquiet is echoed in the words of the Uganda Human Development Report (UNDP 1997), 'the perennial concern is that the benefits of strong growth have yet to translate into measurable improvements in the standard of living for the majority of the people' (UNDP 1997:2). This conflicting evidence therefore calls for a re-examination of the issue. Uganda, therefore, presents an appropriate laboratory for the analysis of the welfare effects of the removal of trade barriers in developing countries.

Given the complexity of forces affecting the household, it is important to avail of analytical tools that are able to disentangle these different influences. Computable General Equilibrium (CGE) analysis extends beyond isolating these influences to capturing crucial sectoral inter-dependencies and feedback effects within the economy. Its principal attraction lies in its solid microeconomic theory foundation, which facilitates the explicit modelling of the behaviour of economic agents; namely consumers, producers and governments. Furthermore, standard CGE analysis enables the evaluation of welfare changes based on compensating and equivalent variation, which have firm foundations in micro-theory.

This fresh investigation of the welfare effects of trade liberalisation, therefore, is motivated by three key concerns. First, given the pivotal role of households, an appropriate household disaggregation would provide deeper insight into the effect of domestic policy reform on household welfare. Second, to extend the regional coverage of household welfare-based CGE models which have hitherto mainly looked at West African Economies particularly Côte d'Ivoire and Gambia[1] to cover Uganda which has undertaken massive trade policy reform particularly in the 1990s and has been heralded as a success story. Third, we are able to simulate actual tariff reforms undertaken in Uganda introducing realism in the model in contrast to most CGE work that simply postulates tariff changes.

This paper is structured as follows. Section 2 presents a summary of Uganda's trade liberalisation progress and Section 3 briefly reviews the CGE literature. Section 4 describes the model, data and the experiments. Section 5 presents the results before Section 6 undertakes a discussion of the limitations and possible extensions before the conclusion and policy recommendations are presented in Section 7.

2 Trade liberalisation in Uganda

Much has been documented on Uganda's massive strides in trade liberalisation. Morrissey and Rudaheranwa provide a discussion of the major trade policy reforms in Uganda in the period 1987–97 and provide a summary table (1998:7).

The key turning points, particularly relating to household welfare in Uganda, are our main focus of discussion. The liberalisation of the foreign exchange market progressed from rationing under the Open General Licence (OGL) in 1988 and Special Import Programme (SIP) in 1989, to the introduction of foreign bureaux in 1990, culminating in market-determined exchange rates by 1993 (Morrissey and Rudaheranwa 1998).

The abolition of marketing boards particularly coffee in 1992 saw over 100 private companies coming into the coffee export market covering 73 per cent of the market in 1994 and 100 per cent of the market by 1997 (Uganda 1999:94). This improved the farm-gate prices for coffee and boosted production, as farmers were able to receive a greater proportion of the world coffee prices. The associated loss of coffee transport monopoly by Uganda Railways Corporation reduced transaction costs benefiting the farmers even more (Bigsten and Kayizzi 1999). The effects of coffee export tax on household welfare are difficult to trace because of the erratic nature in which it was

[1] Lately, Philippines and Malawi CGE models have been undertaken.

applied. It was abolished in 1992, reinstated in 1994 and then abolished again in 1996. Given that smallholder poor farmers grow coffee, the progress with the liberalisation of coffee had a direct positive effect on poverty (Appleton 2001).

The progress in reduction of tariffs from a maximum band of 60 per cent in 1992 to a maximum band of 20 per cent in 1997 served to reduce tariffs on imported inputs lowering the cost of production for farmers.[2]

3 CGE literature review

CGE models are best suited to capture the welfare effects of the policy change within the economy since they take into account interactions and interdependencies within the economy. It is no surprise therefore, that the increasing interest in the welfare of the poor has seen a prolific increase in CGE-based welfare analyses such as Dorosh and Sahn (2000), Robilliard et al. (2001), Lofgren et al. (2001), Bautista and Thomas (1997).

While several multi-country CGE models have been developed, we limit our discussion to single country multi-sectoral CGE models. The literature can be divided into two broad strands – one considering the modelling issues in CGE models and another, the suitability of CGE models for the analysis of household welfare in general and poverty and income distribution issues in particular. We merge these two issues in the discussion here.

While CGE work on the indirect effects of trade liberalisation on income distribution and poverty via its effect on GDP continues to grow, the CGE literature on the direct links is rather scanty and is only recently gaining prominence. Bandara (1991) provides a useful summary of early CGE work (1959–83), ranging from those concerned with trade policy issues (1967–81) to models developed for income distribution analyses (1959–71). We provide a selective update of the recent CGE models with special emphasis on those with trade policy and welfare applications in Table 1.

Table 1 shows the range of the modelling framework used in CGE models, the choice of which has largely been driven by the balance between tractability and realism.

Considering the production-side modelling, three main functional forms have widely been used. Bautista and Thomas (1997) used the Leontief production function that requires a minimum level of each input to produce a unit of output. Although this is a convenient choice, it is limited by the non-substitutability between factors of production but is appropriate for the consideration of production in the short-run. Cobb-Douglas (CD) production function's greater substitutability is limited by its unitary own price and income elasticity of demand.

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2 We discuss tariff liberalisation in greater detail later in the paper.

Table 1

Selective summary of recent CGE-based work

Author, country, year	Household Disaggregation	Model Structure	Experiments	Results
Dorosh and Sahn (2000), Sahn, Dorosh and Younger (1997) Cameroon Gambia Madagascar Niger SAMS 1989–93	4 households – Urban non-poor – Urban poor – Rural non-poor – Rural poor	Value added – modelled as CES Production – Disaggregated into agriculture, industry, tertiary Land – disaggregated by ecological region Consumption – modelled as fixed value share of total expenditure Gambia/Niger LES – Cameroon/Madagascar No modelling of monetary /financial variables Armington assumption CET specification for exports	Current account held constant across all simulations Tightening of world capital markets and foreign aid inflows modelled as a 10 per cent reduction in world price of major export good Shocks – Implicit tariff on imports set high enough to keep real exchange rate fixed – Real exchange rate depreciation – Exchange rate depreciation & reduction in govt spending – Maintaining govt revenue. through increased taxes	Focus – GDP growth – Investment – Foreign savings – Income distribution among 4 households – Trade & exchange rate liberalisation benefits poor households in urban and rural areas
Bautista and Thomas (1997) Philippines SAM 1979	5 households – 3 rural – 2 urban	PROD – Nested CES and Leontief 4 primary factors	Import rationing Uniform surcharge on imports Tariff liberalisation Tariff reduction and 50 per cent reduction in current account deficits	Favourable income and equity effects of import liberalisation

Table 1 continues

Author, country, year	Household Disaggregation	Model Structure	Experiments	Results
Lofgren, Chulu, Sichinga and Simtowe (2001) Malawi SAM 1998	14 households – 5 rural agricultural – 4 rural non – agricultural – 5 urban	Small Open country assumption CET specification for exports Armington assumption Land and capital sector-specific Labour flexible	Changes in international prices of tobacco and petrol products Variation in real exchange rate	Lower tobacco price plus higher petrol prices penalise non agricultural population Real depreciation has pro-rural bias Real appreciation benefits urban population
Robilliard, Bourguignon and Robinson (2001) Indonesia Use micro simulation and standard CGE SAM 1995	10 households 38 sectors 15 factors of production – 8 labour based on sex, urban/rural & skilled / – unskilled – 6 capital categories – 1agricultural specific land 15 goods	Value added – modelled as CES Fixed Leontief intermediate inputs Imperfect substitutability between formal & informal products of each product Armington assumption CET specification for exports Savings-investment balance	Historical simulation involving real devaluation, domestic credit crunch, foreign credit crunch, El Niño Historical & macroeconomic counterfactuals Historical & food price subsidy, public works program and targeted household transfers	El Niño more important for negative household welfare effect than credit crunch Household transfer programs most efficient to reduce poverty and targeting based on pre-crisis income levels inefficient

Constant Elasticity of Substitution (CES) production function is popular (Dorosh and Sahn, 2000) as it addresses the problems of CD but its main draw back lies in its imposition of unitary income elasticity. Increasingly, to allow for greater flexibility, researchers have combined different functional forms through nesting (Bautista and Thomas 1997).

Consumption has been modelled using standard functional forms such as CD or CES. The Linear Expenditure System (LES), a modification of the CD and CES, which introduces a minimum level of demand for each good thereby removing the unitary elasticity of demand has also been used (Dorosh and Sahn 2000)

There are three closure rules – external, government and macro-economic closure. The external closure defines how the domestic economy interacts with the rest of the world. Use has ranged from the assumption of the small to large open economy depending on the nature of a country's influence on world prices. The government closure, which determines the manner of government modelling, has been dictated by specific country conditions. Regarding the macroeconomic closure, a choice has been made between the Keynesian, Kaldorian, Johansen and Classical closure rules. The Keynesian closure allows for unemployment and a fixed nominal wage while the Kaldorian closure assumes a flexible wage rate, which adjusts to ensure full employment. The Johansen closure is one with exogenous investments so consumption adjusts endogenously. The Classical closure rule assumes that real investment is endogenous and adjusts to total available savings.

In spite of the different modelling framework outlined above, the consensus in CGE-based work appears to be the beneficial (albeit marginal) impact of trade liberalisation on the poor in the long run, although they may incur short run adjustment costs.

4 Uganda CGE Model[3]

4.1 Macro-SAM

The macro-SAM for Uganda for 1992 on which the CGE model is based shows GDP at factor cost amounting to 3,480,929 million Uganda shillings at 1992 prices (see Table A1 in the Appendix). It shows that output of activities, that is, domestic production is largely demanded by the household sector (61 per cent) while a considerable proportion (19 per cent) serves as intermediate inputs. The reminder is distributed between government, rest of the world as exports, investment and stocks. Households are shown to derive 86 per cent of their income from factor income payments while the rest accrues from government and inter-household transfers. The government account earns a massive 20 per cent of its income from import tariffs, a feature typical of developing countries. It derives 69 per cent from transfers from the ROW, 8 per cent and a measly 3 per cent of its income from taxes on domestic production and household incomes respectively. The ROW supplies intermediate inputs to domestic production and goods for household consumption as well as investment goods.

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3 We are grateful to Adam Blake who provided the Uganda SAM and CGE model used in Blake et al. (2001) which we adapt for our analysis.

4.2 Micro-SAM

This is disaggregated to 50 sectors and 10 household groups, discussed in greater detail below.

4.2.1 Household disaggregation

Recently, there has been much discussion about the suitability of the use of the representative household groups compared to individual households for the analysis of policy reform.[4] In fact, this is only a renewed interest as Pyatt and Thorbecke (1976) laid down the blueprint for household disaggregation that has been adhered to in several subsequent analyses. They argue persuasively for a household disaggregation that minimises within-group heterogeneity. This is achieved in the Uganda SAM through the segregation of wage and non-wage rural and urban households as well as the unemployed and agricultural households.

Recent assessments (Dorosh and Sahn 2000) show that it is imperative that country-specific features be considered. Uganda's large dependence on agriculture[5] is captured in the model by the devotion of almost half of the household groups to it. agricultural households are sub-divided by region because recent investigations (for example, Appleton 2001**)** point to regional disparities in Uganda with central and western Uganda relatively better off than the eastern or northern part of the country. Furthermore, household classifications should be chosen to reflect the policy focus of the investigation under review (Dorosh and Sahn 2000), in this case, trade liberalisation.

Table 2

Household classification

	Household group	Household income as a percentage of GDP
1.	Urban wage earners	12
2.	Rural wage earners	10
3.	Agricultural, central	14
4.	Agricultural, eastern	14
5.	Agricultural, western	15
6.	Agricultural, northern	9
7.	Urban non-farm self employed	12
8.	Rural non-farm self employed	9
9.	Urban non-working	1
10.	Rural non-working	3
	All households	99

Source: Blake et al. (2001); households do not total 100% due to rounding off.

4 See Decaluwe et al. (1999) for a flavour of the main arguments.

5 This accounts for 50 per cent of employment and 90 per cent of export earning (Morrissey and Rudaheranwa 1998).

The consideration of the above criteria for household disaggregation generated ten representative household groups namely urban and rural wage earners as well as non-farm self employed, non-working and the agricultural households, distinguished by region. Table 2 shows the distribution of household income as a percentage of GDP. Obviously, the poorest households are the non-working households mainly reliant on transfers. The rural non-working are slightly better off than their urban counterparts because of higher transfers from relatives working in urban areas. Consistent with documented work on poverty in Uganda (Appleton 2001), the agricultural north is the poorest of the agricultural regions, only comparable to the rural non-farm self-employed.

Household expenditure outlays consist of consumption, savings, taxation as well as inter-household transfers while household income comprises factor income and transfers consisting of government and transfers from other households.

4.2.2 Factors of production

The Uganda SAM identifies six labour categories disaggregated to non-wage labour distinguished by skill level ranging from high skill (3N) to low skill (IN) and wage labour also classified by skill level from high skill (3W) to low skill (1W). Capital in the Uganda model is not distinguished and is computed residually. Table 3 shows the factorial distribution of income by households. It also includes income from transfers.

The discussion of factorial distributions of incomes and transfers is pertinent because policy shocks from simulations cause changes in relative prices of commodities, which in turn impact on factor use and factor prices, subsequently affecting household welfare.

Table 3

Factorial Source of household Income (%)

Household Group	Cap	1W	2W	3W	1N	2N	3N	Transfers	Total
Urban wage earners	3.15	2.52	10.61	61.60	0.31	1.03	5.09	15.69	100
Rural wage earners	8.46	8.49	13.68	36.38	1.70	4.37	12.09	14.81	100
Agricultural, central	22.84	0.68	1.79	0.85	19.02	30.49	11.63	12.71	100
Agricultural, eastern	21.67	1.34	1.26	0.59	23.98	22.35	12.46	16.33	100
Agricultural, western	22.37	1.18	1.26	0.37	28.28	24.79	9.74	12.02	100
Agricultural, northern	21.09	0.85	0.35	0.86	22.58	18.41	14.89	20.98	100
Urban non-farm self employed	30.25	0.01	0.05	0.64	4.80	13.11	45.68	5.46	100
Rural non-farm self employed	28.61	0.05	0.04	0.14	7.70	20.16	36.01	7.29	100
Urban non-working	61.68	0.00	0.00	0.07	1.82	1.71	2.42	32.29	100
Rural non-working	67.43	0.00	0.00	0.11	0.00	1.43	3.50	27.52	100

Source: Author's computations.

In general, wage-earning households (mainly comprising of public service employees) derive the greatest proportion of their factor income from high-skilled labour while agricultural households (with the exception of agricultural north) receive the bulk of their factor income from non-wage medium skilled labour. The agricultural north households derive the greatest part of their labour income from low skilled non-wage labour, consistent with evidence that educational attainment is much lower in northern Uganda. Self employed households mainly rely on capital and high-skilled non-wage labour while the unemployed households receive the bulk of their factor income from capital. This is rather surprising, however, it ought to be borne in mind that the proportion of total income accruing to these households is very small and so the value of capital would be minimal. Furthermore, in this model capital includes land and so this peculiar result may arise from the manner in which capital is classified.

Transfers comprise both government and inter-household transfers with 73 per cent being government transfers. Although the share of inter-household transfers in total transfers is not substantial, their importance needs to be underlined as their significance has been highlighted by Chia et al. (1992) who demonstrate that dependence on inter-household transfers, particularly by the rural poor alters the nature of incidence of reforms. This is because they generate both 'first-round' and 'second-round' effects, that is, the effect of a policy change that results in reduced incomes for the urban rich (say) is indirectly transmitted to the rural poor through reduced inter-household transfers. Similarly, it is plausible to argue that policies that change government revenues impact on government transfers, thereby affecting household welfare.

Not surprisingly, the non-working households are the largest recipients of transfers representing about 30 per cent of their income. Self-employed households have the least proportion of transfers to income while the rest of the households receive between 10 and 20 per cent of their income from transfers.

Next, we consider the intensity of factor use by sectors presented in Table 4. This is important because policy changes affect prices of commodities, which in turn impact on factors used, thereby affecting household incomes.

The non-tradable agricultural sector (agric) heavily relies on the use of 2N and 1N while the traditional export sector (trade) is intensive in the use of capital and to a limited extent, 3W. The processing sector (process) intensively uses capital while sugar manufacturing (sman) mainly demands 2W and 1W. Food manufacturing (fman), manufacturing (manuf), marketing (markt) and the transport sector (transp) intensively use capital. The services sector (serv) mainly demands 3N and capital while the public sector is intensive in its use of 3W.

4.2.3 Model description

The CGE model for Uganda is a standard static Walrasian neo-classical specification and follows in the tradition of application of CGE models to developing countries (Dervis et al. 1982) and standard CGE modelling structures (Blake et al. 1998). It is Walrasian because equilibrium in n markets is assured by equilibrium in (n-1) markets.

Table 4

Share of primary factors in value added

	Cap	1W	2W	3W	1N	2N	3N
Agric	0.194028	0.016668	0.020797	0.008347	0.272528	0.309961	0.177671
Trade	0.457061	0.048726	0.089511	0.300044	0.014224	0	0.090434
Process	0.521586	0.034375	0.025412	0.148326	0.030285	0.123487	0.116529
Sman	0.230741	0.306439	0.397819	0.065001	0	0	0
Fman	0.841228	0.016358	0.021448	0.030326	0.017268	0.041933	0.031438
Manuf	0.228353	0.028434	0.066833	0.188205	0.148134	0.184271	0.15577
Markt	0.540105	0.002286	0.007841	0.062659	0.026268	0.090588	0.270252
Transp	0.605518	0.013466	0.074285	0.179289	0.005111	0.031434	0.090898
Serv	0.289417	0.030042	0.083799	0.230483	0.016848	0.039092	0.310319
Public	0.039701	0.024599	0.057924	0.830402	0.006032	0.008269	0.033072

Source: Author's computations.

Constant returns to scale technology is assumed as well as Leontief relationships between output, intermediate inputs (aggregate of domestic and imported goods) and aggregate value added. Standard CES nesting structures for value added (VA) as a function of capital and six categories of labour are employed. The double-Armington assumption is used to distinguish imports and domestically produced goods, implying imperfect substitutability and also to differentiate exports from goods for domestic use. The composite production good is therefore a Constant Elasticity of Substitution (CET) aggregation of sectoral exports and domestically consumed producer goods. This implies that producers maximize profits subject to imperfect substitutability between export production and production for the domestic market. These assumptions of imperfect substitutability and transformability protect the domestic price system from international prices and therefore dampen export and import responses to changes in the producer environment. This treatment of exports and imports provides a continuum of tradability and allows two-way trade (cross hauling) at the sectoral level reflecting the empirical reality in Uganda.

The Linear Expenditure system (Stone-Geary function), a modification of the CD and CES production function which introduces a minimum level of demand for each good is assumed to describe household consumer good demand thus eliminating the unitary elasticity of demand.

The SAM provides the benchmark data for the CGE model calibration. We use the Harberger convention in which all benchmark prices are set to unity causing the benchmark values to be treated as quantities. The model is solved using the Mathematical Programming System for General Equilibrium (MPSGE), a sub-routine within the General Algebraic Modelling System (GAMS). In MPSGE, calibration is undertaken automatically using in-built programs for the specified functional forms.

In contrast to other studies, we rely on actual tariff data for Uganda and apply differential tariff rates across sectors as compared to uniform tariffs rates used in many studies that postulate tariff changes. The tariffs are only applied to 28 out of 50 sectors at the disaggregated level, which translates to 6 out of 10 sectors at the aggregate level. In other words, the replicated model is shocked with Uganda's actual tariff liberalisation in the 1990s. Table 5 shows the applicable tariffs at the aggregated level over the period 1992 to 2000.

Table 5

Tariffs in Uganda by aggregate sectors

	1992	1994	1995	1996/97	1997/98	1998/99	1999/00	2000/01
Agric	0.083	0.189	0.170	0.120	0.094	0.076	0.076	0.076
Fman	0.086	0.232	0.236	0.252	0.172	0.134	0.132	0.132
Sman	0.215	0.166	0.191	0.168	0.168	0.132	0.132	0.132
Process	0.098	0.188	0.210	0.168	0.141	0.132	0.132	0.132
TradExp	0.076	0.271	0.324	0.256	0.176	0.132	0.132	0.132
Manuf	0.181	0.151	0.184	0.152	0.115	0.087	0.090	0.093

Source: Author's computations aggregated from Uganda Revenue Authority Data.

Tariffs in the 1992 are derived from Uganda's 1992 Social Accounting Matrix and are computed as the ratio of imports at domestic prices to imports at world prices less 1 and are applied to 28 tradable sectors with an average of 13.7. The bulk of the tariffs were on sugar manufacturing (sman) at 21.5 per cent followed by the manufacturing sector (man) with an average of 18 per cent. The highest single sector tariff was on the chemical products (classified under manufactures) which also had the highest proportion of imports. The food manufactures sector (fman)'s tariffs were about 9 per cent. The non-tradables agriculture sector and the export sector attracted the lowest tariffs.

This tariff structure, admittedly, is very low as some commentators on the Ugandan economy estimate the average nominal tariffs in 1992 to be higher. We argue that 1994 tariffs are a better reflection of the tariffs that existed in Uganda in the early 1990s and subsequently use it as a 'benchmark'. Examining the tariffs in 1994 drawn from Milner et al. (2000), we observe that the traditional export sector faced the highest tariffs at about 32 per cent while the agricultural sector faced the lowest tariffs over the period 1995–2000. This period, overall, witnessed a decline in tariffs in all sectors with the exception of the food manufacturing sector, which experienced a modest (1.6 per cent) increase in tariff levels between 1995 and 1996/97, and the sugar-manufacturing sector between 1996/97 and 1997/98. The manufacturing sector witnessed a 30 per cent fall in tariffs over the period 1995–96/97. Data on 1995, drawn from a different source shows considerably higher tariff levels than the subsequent years highlighting the differences arising from different data classification and aggregation methods. Data from 1996/97 to 2000/01 is drawn from the Harmonised System (HS) of tariff data compiled by the Uganda Revenue Authority and is therefore more comparable.

The post 1996 period witnessed a continued fall in tariffs in all sectors with the food manufacturing and traditional export sectors experiencing falls of up to 30 per cent. The post 1997 period saw a move towards harmonisation of tariffs with all the tariff levels lying between 5 and 15 per cent.

We use the low initial starting point of tariffs (1992) to replicate the benchmark, a crucial underpinning of any CGE work. However, subsequently the 1994 equilibrium based on the 1994 tariffs, obtained from Milner et al. (2000) is used as the benchmark for comparison with subsequent years.

Before we proceed to the discussion of the results, three key issues deserve special mention. First, the consumer price index is used as the numeraire consistent with the standard approach in CGE modelling. Second, the results are obtained using 1992 as the base year and then re-evaluated using 1994 as the new base year, so the reported results correspond to the 'adjusted' outcomes. Third, the Hicksian Equivalent Variation captures the welfare change. This has strong micro-economic foundations and is the standard approach in CGE modelling work. It is essentially a measure of the change in income that is equivalent in its effect on utility to a change in the price of the commodity. That is, given the households' consumption bundle before the price increase, an evaluation is made of the amount that the government would need to take away from the household to reduce its welfare as much as the price increase does and vice versa for a price decrease.

5 Results

Recall that the period 1994–2000 overall witnessed a reduction in tariffs. However, the sub-period 1994–95 witnessed a substantial increase from 17.9 per cent in 1994 to 20 per cent in 1995,[6] the traditional export sector witnessed the highest increase of 19.5 per cent while the agricultural sector recorded a 9.7 per cent fall in tariff levels over this period. The period between 1995 and 1996 saw a reduction in the average level of tariffs to 16.2 per cent with the greatest reduction of 36 per cent in the agricultural sector. Between 1996 and 1997 there was a 4 per cent decline in tariffs to an average of 12.3 per cent. Tariff reforms in 1998 brought the mean tariff level down to 9.8 per cent, a level around which it stabilised until 2000/01.

As expected, the tariffs alter the prices of imported goods for all sectors on which are applied impacting on production as well as consumption. The impact on production is channelled through imported goods used as inputs into the production process as a component of the composite input (domestic and imported intermediates), which is then combined with intermediate value-added using a Leontief production technology for production. In addition, the imported good is also part of the composite good that enters into the households' utility function. A medium-high elasticity of two between the domestic and intermediate good in forming the composite implies a modest substitutability between the imported and domestically produced input. The choice of elasticities in production and consumption may influence the outcomes and we undertake a sensitivity analysis to check the robustness of our results.

5.1 Macro-effects

First, we consider the effects of the tariff liberalisation on macro aggregates, namely, GDP and trade, that is, imports and exports. Table 6 presents the summary of results on the macro-aggregates.

There are only marginal changes (ranging from a two per cent increase and a three per cent fall) in GDP over the period of investigation. When tariffs are reduced between

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6 Recall that this may only be due to different data sources.

1995 and 1998, GDP falls and only begins to rise after 1998. It stabilises in the post 1999 period when tariff rates are more or less stable. This fall in GDP (albeit marginal) is contrary to results found in partial equilibrium work that has relied on composite openness indicators. Only limited work[7] has been done using direct openness indicators and this work, surprisingly, finds a positive relationship between tariffs and GDP. Our results underscore the importance of taking into account sectoral inter-linkages, largely ignored in partial equilibrium. Given that tariffs are only one aspect of trade liberalisation it would be misleading to argue that trade liberalisation appears detrimental to growth. Rather, the results call for a cautious consideration of partial equilibrium work. It ought to be emphasized that the specificity of capital in this model essentially implies that is short-run in nature. The results, therefore, point to short-run adjustment costs in the economy following liberalisation. This is consistent with results by others such as Cornia et al. (1987) and Taylor (1988).

The effects of the removal of trade on imports, exports and on trade in general are captured in rows 3–5 in Table 6 and shown as Charts 2 and 3 in the Appendix. Relative to 1994, imports start at a high level in 1995 then steadily decrease until 1998. There is then a sharp rise in 1999 after which they become constant, largely because of unchanged tariffs. The high volume of imports in 1995 is surprising and may point to a lag between change in trade policy and change in import volumes. In particular, note that the results for imports are largely driven by chemicals (classified under manufactures) which see a sharp tariff rise between 1994 and 1995 from 15.1 per cent to 20.4 per cent, this effect is evident in the large decline in imports in 1996.

Considering the effects of these reforms on exports, we observe a general upward trend in exports over the period of liberalisation until 1998 then a fall in exports. The impact of tariff liberalisation on exports is transmitted through changed prices of imported intermediates and the secondary effects on the exchange rate, which determines their competitiveness. The overall effect on trade is largely driven by imports, which form 80 per cent of total trade (Table 6, row 5 and Chart 4 in Appendix).

Table 6

Macro-effects of reduction of trade

	1994–95	1994–96	1994–97	1994–98	1994–99	1994–00
GDP	1.016913	0.993733	0.975661	0.968737	0.986993	0.986236
Imports	1.03335	0.995862	0.976808	0.969756	1.108233	1.111235
Exports	0.988239	1.007299	1.015182	1.019945	1.006313	1.00753
Trade	1.023047	0.998474	0.985573	0.98122	1.084954	1.087548

Source: Author's computations from results of simulation in MPSGE. All results are relative to 1994, which takes the value of 1.

7 This includes work by Rodrik (2001) which uses weighted tariffs.

Two important issues arise from the consideration of the effect of the removal of tariffs at the macro level. First, it highlights the importance of interactions within the economy, completely ignored in partial equilibrium work and points to the possibility of short-run adjustment costs in the economy. Second, it amplifies the need for the development of 'better' openness indicators able to capture the direct features of trade liberalisation such as tariff liberalisation (Rodrik 2001).

5.2 Micro-effects

In this section we consider the effects of tariff at the micro-level, that is, at the sectoral and the household level. To conserve space, the complete results showing the sectoral output for domestic sales and exports as well as the price of imported goods, exports and value added are excluded but are available on request. Table 7 presents the results of the simulations on household welfare, the central subject of our analysis.

Two crucial issues regarding the short-run household welfare outcomes deserve special mention. First, we observe that overall, there are only marginal albeit differential welfare changes for the household groups. Second, agricultural households enjoy the greatest gains from the reforms although on average households appear to experience short-run losses from tariff liberalisation. The welfare gains can be explained with reference to three key factors.

First, the role of interactions between sectors and factor markets, a key strength of CGE analysis, not surprisingly, plays a central role in welfare outcomes. Although the period 1994–95 experiences overall increases in tariffs, the reduced tariff in the non-export agricultural sector drives the welfare gains. It induces an increase in imports of agricultural products intensively used in the processing sector which, in turn, expands increasing returns to capital which is intensively used in the sector thereby improving the welfare of households 9 and 10, heavily reliant on capital returns. The crucial point here is that welfare gains for the poor are largely driven by the changes in the non-export agricultural sector in which they are engaged. This suggests that if the poor are to be gain from policy reform, the dismantling of the anti-agricultural bias which largely prevailed in the pre-liberalised economy is fundamental. Admittedly, this is dismantling is more difficult in a general equilibrium context with several economy-wide ramifications.

Table 7

Effect of tariff liberalisation on household welfare

Household	1994–95	1994–96	1994–97	1994–98	1994–99	1994–2000
1	1.002008	0.998996	0.996988	0.99498	0.997992	0.996988
2	1	0.998994	0.997988	0.996982	0.986922	0.986922
3	0.999004	1.000996	1.000996	1.001992	0.998008	0.998008
4	1	1	1.000998	1.000998	1.001996	1.002994
5	0.999002	1	1.000998	1.001996	1	1.000998
6	1	1	1	1	1.006993	1.007992
7	0.995045	1.000991	1.002973	1.002973	0.978196	0.977205
8	0.995025	1	1.00199	1.002985	0.976119	0.976119
9	1.006091	0.99797	0.995939	0.995939	1.029442	1.029442
10	1.005092	0.996945	0.994908	0.995927	1.021385	1.022403

Source: Author's computations from simulation output from MPSGE.

The welfare outcome for households 1 and 2 are determined by changes in the public sector, mainly demanding highly skilled labour (3W) with which these households are endowed. In the period 1994–95, the public sector expands while it contracts over the period 1996 to 2000 as a result of feedback effects. This explains the resultant welfare changes in households 1 and 2.

Furthermore the role of interactions is illuminated over the period 1994–96. The reduction of tariffs in the agricultural sector causes an increase in demand for the imported agricultural goods resulting in the contraction of the domestic agricultural sector intensive in the use of 2N thereby decreasing rewards to household 3 with the highest 2N/income share. This decrease is however, overcompensated for by the expansion in the marketing sector (as a feedback effect) which increases returns for 3N resulting in net welfare gains for household 3.

Second, we see changed import tariffs impacting on the volume of imports and thereby affecting the exchange rate. Specifically over the period 1998 and 2000 the overall reduction in tariffs on all the sectors results in an increase in imports, the effect of which is two-fold. First, export sectors are able to access cheaper imported intermediate inputs, causing exports to increase and second, the increase in imports causes a depreciation of the exchange rate increasing export competitiveness. In response, the changed export incentives stimulate an increase in exports although the limited reaction from the coffee-processing sector primarily from the perennial nature of coffee is a matter for concern given its prominence in Uganda's export structure.

Third, the results underscore the importance of transfers, that is, both government and inter-household transfers, although the emphasis is on the former given that the bulk of transfers comprise of government transfers. The period 1996–98 sees a reduction in tax revenue. Recall that a substantial share (20 per cent) of government revenue is derived from import tariffs. However, it is not possible to tell *a priori* whether a tariff reduction will be revenue depleting or revenue enhancing (Greenaway and Milner 1991). So, a reduction in import duties that is not compensated by increased revenue from a wider import tax base results in lower tax revenue which in turn results in lower transfers negatively impacting the households that are heavily reliant on them as is the case in 1996–98. However if the volume of imports and therefore tariff revenue more than offsets the lost tariffs revenue from the reduction in tariff rates, then tariff revenue and therefore transfers would increase. The period 1999–2000 is a case in point. Despite the tariff reduction, tax revenue increases by 0.32 per cent resulting in increased transfers of 10.1 and 10.4 per cent in 1999 and 2000 respectively, benefiting households 9 and 10. The importance of transfers is not new. Early proponents of their importance include Chia et al. (1994) who demonstrated its pertinence in the context of inter-household transfers. The novel result, however, shows that the impact of transfers can be broadened to include government transfers.

5.3 Sensitivity analysis

CGE results are usually treated with some scepticism as it is argued that the results are driven by assumptions made. We undertake sensitivity analysis by altering our elasticity of substitution parameter from 2 to 0.5, a considerable change implying considerably lower substitution levels. We present the results on the impact on household welfare in Table 8 (the full results are available on request).

Table 8

Sensitivity analysis $\sigma = 0.5$

	1994–95	1994–96	1994–97	1994–98	1994–99	1994–00
1	1.002008	0.998996	0.995984	0.99498	0.997992	0.997992
2	1	0.998994	0.997988	0.996982	0.987928	0.986922
3	1	1	1.000997	1.000997	0.997009	0.997009
4	1.000999	1	1.000999	1.000999	1.001998	1.001998
5	1	1	1.001998	1.001998	1.000999	1.000999
6	1.001	1	1	1.001	1.007	1.008
7	0.998012	1.000994	1.002982	1.003976	0.980119	0.979125
8	0.997009	1.000997	1.002991	1.003988	0.978066	0.978066
9	0.99001	1	0.998002	0.998002	1.033966	1.033966
10	0.987988	1	0.997998	0.998999	1.028028	1.029029

Source: Author's computations from MPSGE output.

We expect the magnitude of results to differ because of the varying elasticity assumption. Nonetheless, we are interested in checking for the preservation of signs under the varying elasticities. That is, a consistency between the households that gain, lose and have welfare unaltered

While the period 1994–95 presents an anomaly with some switches on the signs on household welfare, note, however, that these are considerably small changes ranging from 0.010 to 1.7 per cent. There is a remarkable consistency of the results between 1995 and 2000 with the household displaying the same welfare sign showing our results to be generally robust.

6 Limitations and extensions

The general weaknesses of CGE modelling including the prohibitive data requirements, the inability to econometrically estimate elasticities and choose between functional forms as well as the primitive modelling of the financial sector and dynamics are well known. They have been adequately discussed by among others, Reed (1996) so we limit our discussions to the limitations of our work abstracting from the weaknesses inherent in the methodology.

While a distinction has been made in the theoretical literature between effective and nominal tariffs, we, like other CGE studies such as Bautista and Thomas (1997) use nominal tariffs even though this, in principle, underestimates the true protection. The incorporation of effective tariffs therefore presents a possible extension to this work.

Furthermore, tariff reduction simply represents one facet of trade liberalisation. Other reforms undertaken included the abolition of the Coffee Marketing Board monopoly and the removal, reinstatement and subsequent removal of the coffee tax. We could not consider all these influences on the households since it was important to be able to trace the pattern of change.

It would be interesting to extend the study to consider changes in income inequality, however, these can not be directly incorporated in CGE analysis. These can only be more fully analysed using micro-simulations, which is a potential extension to this work.

Furthermore, an analysis of poverty dynamics within the household is precluded by the non-availability of within-household data to generate intra-household distribution but would be a fruitful extension to this work.

7 Conclusions

The results of the CGE analysis caution against broad generalisations on the short-run effects of trade liberalisation on household welfare and underlines the importance of sectoral inter linkages. It underscores the fact that trade liberalisation is not a panacea for developing country problems and calls for complementary policies to ensure equitable gains from trade liberalisation. These could, for example, include reduced transport costs.

Furthermore, it is clear that there are differential gains for households and it is therefore misleading to consider aggregate welfare gains. In our simulations, it is shown that even though the pattern of benefits differs from year to year, overall, the agricultural households, the relatively better off households in Uganda gained most from the trade liberalisation over the period 1994–2000. So, targeted intervention to cushion those that lose out in the process of trade liberalisation as advocated by Rodrik (1999), would ensure equitable gains for all households.

Consistent with Chia et al. (1992), the importance of transfers in altering the nature of incidence of taxes is highlighted. These are particularly important in a developing country such as Uganda where social ties are important. It has important policy implications because it indicates the need for the consideration of secondary effects of policy as the burden of the policy change is usually borne by the poor who are reliant on transfers.

In conclusion, therefore, these results indicate that trade liberalisation is not a 'quick-fix' for developing country problems and the need for it to be complemented by other policies in order to attain household welfare maximization can not be overemphasized.

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Chart 1

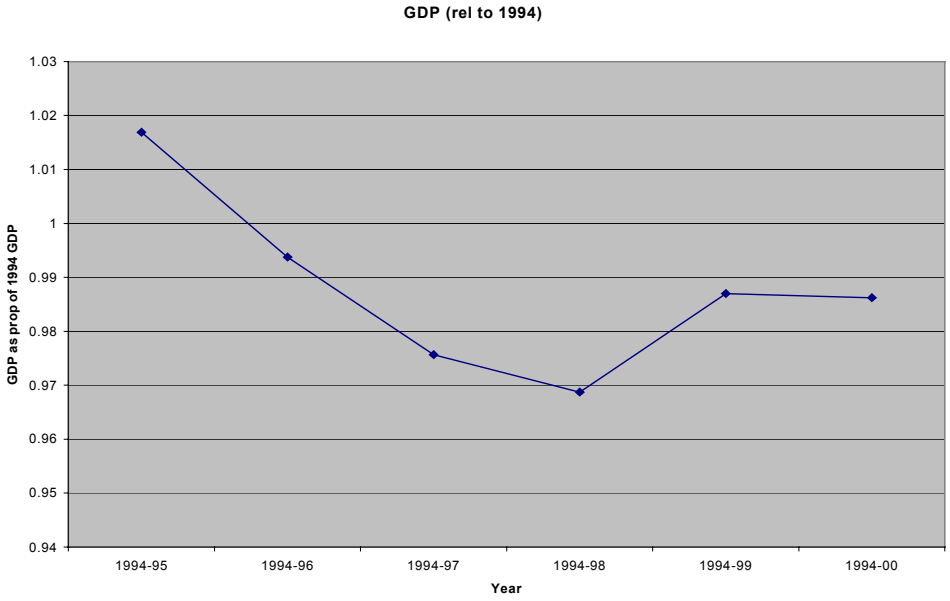


Chart 2

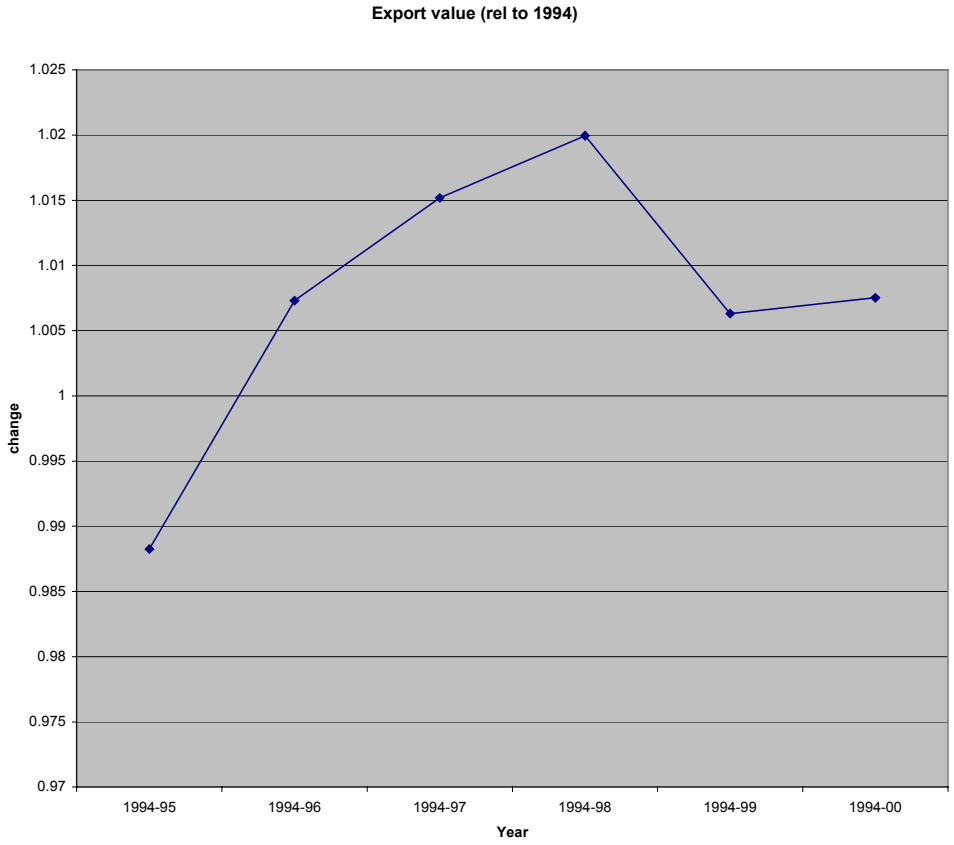


Chart 3

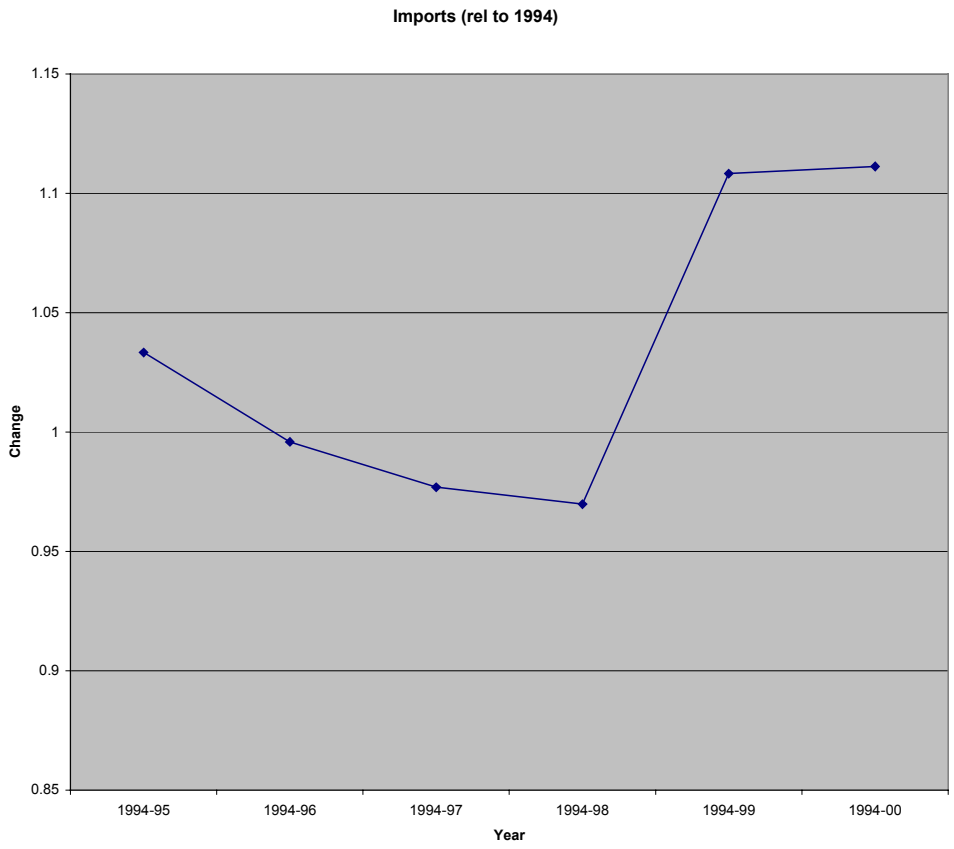
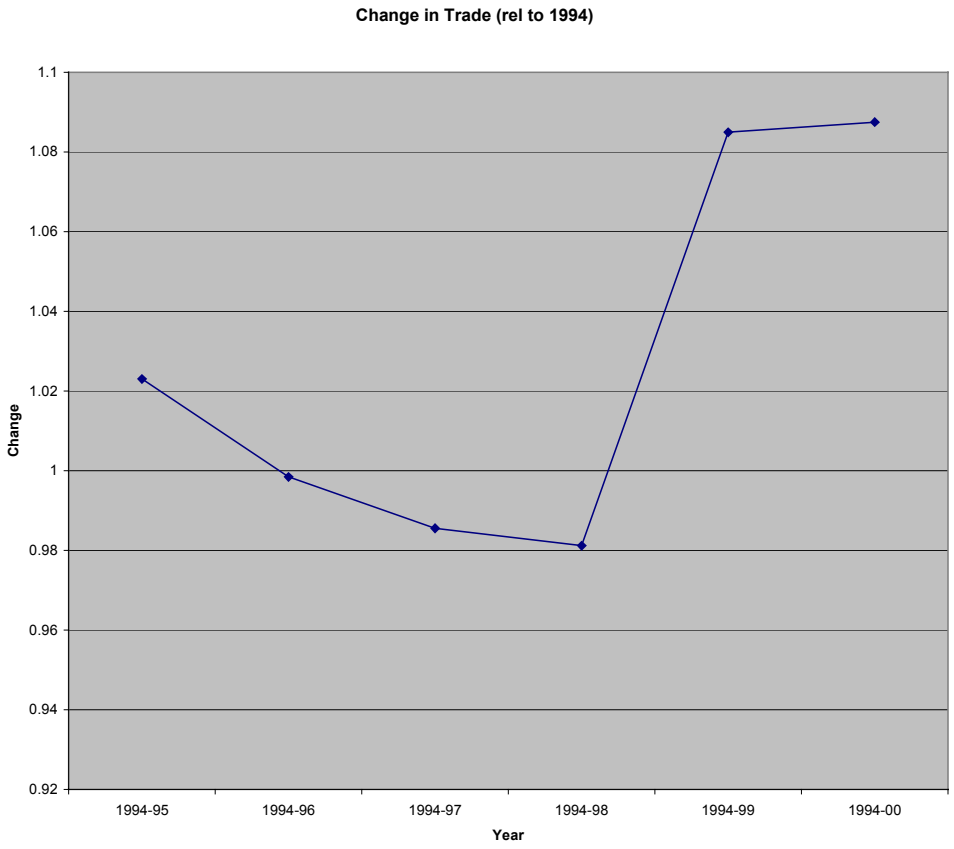

Imports (rel to 1994)
1.15
1.1
1.05
1
0.95
0.9
0.85
Change
1994-95
1994-96
1994-97
1994-98
1994-99
1994-00
Year

Chart 4


Change in Trade (rel to 1994)
1.1
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
Change
1994-95
1994-96
1994-97
1994-98
1994-99
1994-00
Year

Appendix

Table A1
Macro-SAM
(All values are millions of 1992 Uganda Shillings)

Receipt	Activities	Households	Factors	Government	ROW	Investment	Stocks	Total
Activities	955998	3041094		311208	242383	389353	21861	4961897
Households	0	155583	3480929	410437				4046949
Factors	3480929	0						3480929
Government	59608	21853			645627			727088
ROW	465362	281241		0		157824	-16417	888010
Investment	0	547177						547177
Stocks	0	0		5444				5444
Total	4961897	4046948	3480929	727089	888010	547177	5444	14657494

Note: Row and column totals may not be equal due to rounding.
Source: Computation by author.