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South Africa Trade Liberalization and Poverty in a Dynamic Microsimulation CGE Model

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SOUTH AFRICA
TRADE LIBERALIZATION AND POVERTY IN A DYNAMIC MICROSIMULATION CGE MODEL[1].

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ABSTRACT

South Africa has undergone significant trade liberalization since the end of apartheid. Average protection has fallen while openness has increased. However, economic growth has been insufficient to make inroads into the high unemployment levels. Poverty levels have also risen. The country's experience presents an interesting challenge for many economists that argue that trade liberalization is pro-poor and pro-growth. This study investigates the short and long term effects of trade liberalization using a dynamic microsimulation computable general equilibrium approach. Trade liberalization has been simulated by a complete removal of all tariffs on imported goods and services, and by a combination of tariff removal and an increase of total factor productivity. The main findings are that a complete tariff removal on imports has negative welfare and poverty reduction impacts in the short run which turns positive in the long term due to the accumulation effects. When the tariff removal simulation is combined with an increase of total factor productivity, the short and long run effects are both positive in terms of welfare and poverty reduction. The mining sector (highest export orientation) is the biggest winner from the reforms while the textiles sector (highest initial tariff rate) is the biggest loser. African and Colored households gain the most in terms of welfare and numbers being pulled out of absolute poverty by trade liberalization.

JEL Classification: D58, E27, F17, I32, O15, O55

Keywords: Sequential dynamic CGE, microsimulation, trade liberalization, total factor productivity, poverty, welfare, growth, South Africa

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1. INTRODUCTION

South Africa has made significant strides towards trade liberalization since its readmission to the international community after successful free elections in April 1994. This followed years of international isolation imposed on the country due to its racially motivated apartheid policies. Trade liberalization has been accompanied by responsible monetary and fiscal management. The economic performance of the post apartheid economy has been quite strong, averaging growth in real gross domestic product (GDP) of 3.3 percent and 1.35 percent in per capita terms for the period 1995 to 2005. This growth trend was an improvement, if one compares with the rates of the 1985 to 1994 period, where the respective average rates were 0.8 and –1.3 percent. The improved growth performance is largely attributable to strong domestic demand and a large foreign capital inflow in the face of low inflation and interest rates. Although disputed, many authors argue that poverty has been increasing (Hoogeveen and Özler 2004)[2]. Less disputed is the well known fact that South Africa has income inequality that is amongst the highest in the world. At the same time, there was an increase in unemployment as a result of insufficient economic growth and the growing cost of labor relative to capital. Thus, despite carrying out deep and sustained trade liberalization, the economy has failed to grow in sufficient amounts to make inroads into high unemployment, inequality and poverty.

The experience of South Africa presents an interesting puzzle for those who argue that trade liberalization reduces poverty and increases economic growth. This study investigates the short and long term effects of trade liberalization in South Africa using a dynamic microsimulation computable general equilibrium (CGE) approach. In this approach, the endogenous changes obtained from the sequential dynamic CGE model are fed into national survey data for predicted household poverty effects. Trade liberalisation is simulated by a complete removal of all tariffs on imported goods and services, and by a combination of tariff removal and an increase of the total factor productivity. Similarities can be drawn between this work and that of Annabi et al. (2005 a,b)[3].

[2] van der Berg et al. (2005) have recently presented evidence showing that that poverty has sharply declined in the last few years largely as a result of increases in social grants, which have significantly alleviated poverty. However, they agree that poverty levels are still very high.

[3] There is a growing tradition of trade focused CGE modeling in South Africa, starting with the

While South Africa has gone a long way in reducing tariffs, further liberalisation is still conceivable because a number of commodities including processed foods, vehicles and components, tobacco products, rubber products and textiles and garments still receive substantial protection. In principle, therefore, there is scope to check whether further trade liberalisation does indeed lead to an acceleration of growth and productivity through greater allocative efficiency and better resource allocation as well as through factor accumulation effects.

The rest of the paper is organised in the following way: Section 2 presents country background focusing on key trade and macroeconomic policies and poverty. Section 3 presents the model and discusses the data used to run the model and carry out poverty analysis. Section 4 discusses simulations and results obtained. Section 5 summarizes the results, discusses policy observations emanating from the study and suggests areas for future research.

2. COUNTRY BACKGROUND AND POLICY ON TRADE, MACROECONOMICS AND POVERTY

2.1. Trade and macroeconomic policy evolution

South Africa's trade policy is driven largely by the Department of Trade and Industry. According to Bell (1992,1997), South African trade policy was broadly geared towards import substitution between 1925 and the 1970s. By the 1960s, manufacturing growth had begun to slow down. As well, there was dissatisfaction with the continued dependence of the economy on gold for foreign exchange reserves. According to Roberts and Thoburn (2002), this failure of import substitution to enhance growth and diversify the economy away from gold is what triggered a change in trade policy direction away from import substitution beginning in the 1970s. In the 1980s there were renewed attempts to reform the trade regime. Quantitative restrictions continued to be reduced throughout. According to Belli et al. (1993), the

work of Gelb et al (1992) and followed by Cameron et al (1994)[3]. Recent prominent examples of South African CGE work include that of Coetzee et al (1997), Devarajan and van der Mensbrugghe (2000), Gibson (2000), Gibson and van Seventer (1996a,b; 1997a,b), Arndt and Lewis (2000), Thurlow and van Seventer (2002), McDonald and Kirsten (1999), Van Schoor and Burrows (2003), Chant et al (2001), McDonald and Punt (2003a, 2003b), Go et al (2004), Thurlow (2004), Kearney and van Heerden (2005), van Heerden et al (2006), Cockburn et al (forthcoming) and Rattsø and Stokke (2005). There are several other CGE models in use that runs on South African data. Some of these include models at IDC (using a Monash based ORANI model), the World Bank, Global Insight and HSRC.

1980s as a whole ended up being highly protective as South Africa ended up with not only the highest tariff rates but also the widest tariff range. Tariff dispersion had become very high. In 1990 there were renewed attempts to increase exports through the General Export Incentive Scheme (GEIS). In the mid-1990s with political change gripping the country, there was a review of macroeconomic and industrial policy regimes that marked the start of the process of fully-fledged trade liberalization. In 1994, a decision to phase out the GEIS that was considered to be inconsistent with General Agreement on Trade and Tariffs (GATT) and the World Trade Organisation (WTO) rules was reached, and eventually they were terminated in 1997[4].

In 1994 most of the quantitative restrictions had been removed, although quantitative restrictions on agricultural products were still in place. In the same year, the country signed the Marrakech Agreement under the Uruguay Round of the GATT. In that settlement, the country agreed binding 98 percent of all tariff lines. As well, the deal involved reducing the number of tariff lines to six, rationalising the twelve thousand commodity lines and replacement of quantitative restrictions on agriculture by tariff equivalents. South Africa has made a lot of progress towards meeting these commitments, reforming and simplifying its tariff structure. The total number of Harmonised System (HS) 8-digit) commodity lines declined to 6,700 in 2004. The HS 8-digit lines bearing formula duties declined from 1900 in 1993 to 5 in 2002 (WTO, 1998,2002). The number of lines with specific tariffs fell from 500 in 1993 to 195 in 2002. Commodity lines with mixed non-ad valorem duties have fallen from 160 in 2000 to 60 in 2004. Despite these efforts towards simplifying the tariff regime, the number of ad valorem rates still stands at 38 which is higher than the 6 offered in the 1994 GATT/WTO Uruguay Round offer. Including the non-ad valorem tariff rates raises the number to over 100 different rates. This suggests that while progress has been made with trade liberalization, the tariff structure still remains dispersed (discriminatory) and complex.

South Africa's trade policy is not only driven by multilateral arrangements but also by bilateral and regional agreements. The Southern African Customs Union (SACU) between South Africa, Botswana, Lesotho, Namibia, and Swaziland (BLNS) is the oldest Customs Union in the world. It came into force on 1 March 1970 as a replacement of the Customs Union Agreement of 1910. Its main aim is to facilitate

[4] As pointed out in Rangasamy and Harmse (2003), GEIS was also phased out as a result of a policy shift that entailed tariff liberalization as a means of reducing the anti-export bias in the economy.

free trade amongst member countries as well as to provide for a common external and excise tariff to the Customs Union. A key feature of SACU is that all customs and excise collected in the common customs area are shared among members according to a revenue-sharing formula. There are two significant Free Trade Areas (FTAs) that the country has so far concluded. The first is the European Union (EU) – South Africa FTA that was agreed in 1999 and became operational in January 2000. This agreement is asymmetric in nature. While 95 percent of South Africa's exports to the EU will be free of duty at the end of the 12-year lifespan of the agreement, South Africa is obligated to open only 86 percent of its imports from the EU (about 73 percent of its industrial tariff lines) in the same period. There are some exemptions for clothing and textiles, footwear and automotive products where tariffs are scaled down but not completely removed.

The second FTA is with the Southern Africa Development Corporation (SADC) which consists of Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. It came into effect in August 1996 but was not ratified by all parties at that time. The Protocol was implemented in September 2000 after ratification by 11 members. South Africa as the dominant economy in the region is obliged in the agreement to undertake faster liberalisation reforms and a set of "general offers". On the other hand the other countries are allowed a set of "differential offers" implemented over a longer period than South Africa. The agreement is expected to be phased in over eight years. According to this schedule, 98 percent of SADC regional trade should be on duty free basis by 2012.

South Africa still has certain general preference schemes with Zimbabwe and Malawi. South Africa held the first meeting on the Joint Commission of Co-operation with Angola in February 2003. The country also benefits from the United States of America (USA)'s African Growth and Opportunity Act (AGOA) scheme which was signed in 2000. It is estimated that approximately 6500 South African products qualify for export under this preference scheme for 8 years starting in 2000. The USA International Trade Commission estimates that AGOA accounted for US$1.7 billion worth of exports from South Africa in 2004 (30 percent of South Africa exports to the USA), up from US$1.3 billion in 2002. The expiry of the Agreement on Textiles and Clothing (ATC) in December 2004 has the likely effect of narrowing the difference on export prices of AGOA-eligible countries and AGOA – non eligible competitors such as China and India. There are other planned FTAs with India, the USA and

MERCOSUR (Argentina, Brazil, Paraguay and Uruguay) countries. In addition South Africa and Tanzania have signed a memorandum of understanding on trade and industry programmes and a general agreement on economic, scientific, technical and cultural co-operation.

Since South Africa emerged from the apartheid era in 1994 it has had an urgent need to complement political liberation and openness to global trade and investment with economic growth that would benefit all members of the population. Trade liberalisation was accelerated in 1994 and was supported by tariff liberalisation, export orientation policies, and the Reconstruction and Development Programme (RDP). The RDP was aimed at reducing mass poverty and social inequality. The strategy to address the inherited poverty and inequality rested upon the RDP's four pillars, namely building the economy, meeting basic needs, developing human resources and democratizing the state. Government departments were then supposed to ensure that poverty reduction aims are met through directly targeting the poor via service delivery. The RDP was succeeded by the Growth, Employment and Redistribution (GEAR) macroeconomic strategy in 1996. GEAR was aimed at reducing fiscal deficits, lowering inflation, maintaining exchange rate stability, decreasing barriers to trade and liberalizing capital flows. As priorities shifted from stabilization towards development, government commenced work on a new initiative in 2003 and subsequently launched officially the Accelerated Shared Growth Initiative for South Africa (ASGISA) in February 2006. In broad terms, it aims to lift GDP growth to a sustained 6 percent per annum by 2014 by reducing obstacles, share this growth more equitably, and allow South Africa to achieve its Millennium Development Goals (MDGs). Labour absorption is another target to come out of this increased growth. Improvements in infrastructure, stabilization of the currency, reduction of inefficiencies and costs of doing business, increase in skills of workers, removing barriers to entry and to competitions are all the various ways incorporated within the initiative. While generally welcome, a number of analysts have raised several cautions, including issues of capacity in key public sector areas, skills shortage and infrastructure backlogs.

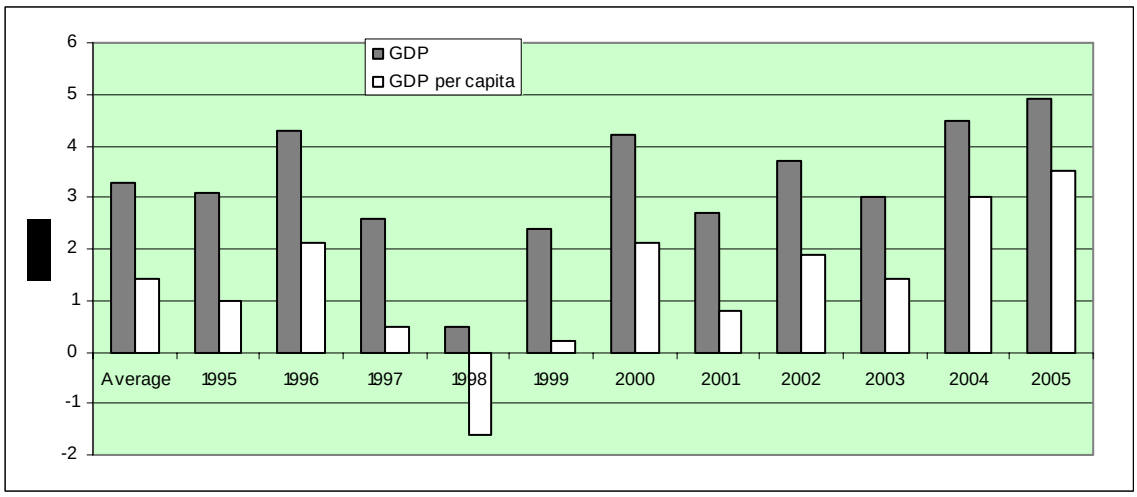
Since 1994, public spending on the poor has taken two main forms, namely mainstreaming social expenditures into government budgets and separate, specialized poverty relief funds. Most of the financing for poverty reduction is planned so that it occurs through the regular budget of the various government departments. These mainstream interventions can be disaggregated into three basic forms of

social development programmes, namely infrastructure programmes (directed at the provision of basic household and individual needs, incorporating local public goods and services such as water, sanitation, energy, housing, health and education), social security system (which extends safety nets to certain cohorts and includes non-contributory and means-tested social assistance grants provided by the government to vulnerable groups that are unable to fulfil their basic needs, namely child grants, the old age pension and the disability grant, and other measures such as school feeding programmes) and social expenditure focused on job-creation measures (entails skills training, the promotion of small, medium and micro enterprises, job summit programmes, expanded public works programs and land redistribution). Many social and human rights have also been secured through the constitution, offering legal protection to the poor, vulnerable and marginalized. Furthermore, policies have been put in place to overcome the legacy of inequality by means of affirmative action in the labour market and by black economic empowerment (BEE) policies to encourage asset transfers towards the previously disadvantaged ethnic groups.

2.2 Macroeconomic outcomes

As shown in Figure 1, the economic performance of post apartheid South Africa has been improving gradually, from an average real GDP growth rate of about 3 percent between 1995 and 1993 to 4.5 percent in 2004 and 4.9 percent in 2005. Per capita GDP growth has followed a similar trend.

Figure 1: GDP and GDP per capita growth rates (constant 2000 prices)



Source: South African Reserve Bank (SARB) database (www.reservebank.co.za).

Table 1 shows that the major sources or drivers of this economic performance have been final consumption by households, followed by exports and then final consumption by general government. Final household consumption by far outstripped the contributions made by the other components, at least doubling the contribution made by exports, the second highest contributor. The average contribution for the 1995 –2005 period was 63.4 percent for household final consumption whilst that of exports, the second highest was 26.4 percent.

The increased improvement in the country's real growth performance was also associated with a marked improvement in most aggregate expenditure components. Expenditure on imports, gross fixed investment, exports and household expenditure on goods and services have all grown by over 4 percent while government expenditure on goods and services has lagged behind growth in these other categories. A worrying feature is the sharp growth in imports relative to exports and the rest of the economy, which raises concerns over balance of payments problems.

Table 1: GDP by expenditure category and category growth rates (average 1995 – 2005)

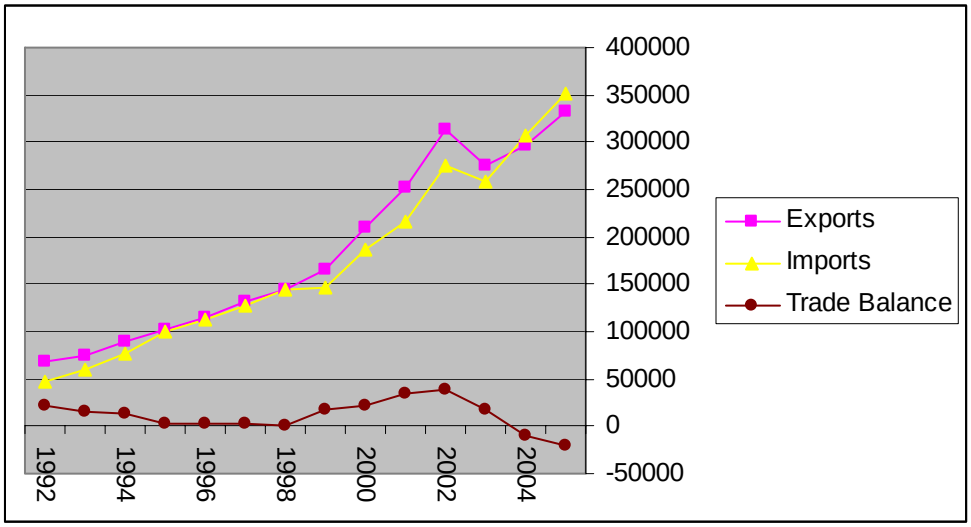
	Share of GDP (percent)	Growth rates (percent)
Final consumption expenditure by households	63.4	4.1
Final consumption expenditure by general government	18.9	2.5
Gross fixed capital formation	15.9	5.6
Exports of goods and services	26.4	4.4
Imports of goods and services	26.3	6.2
Expenditure on gross domestic product	100	-

Source: Calculations using data from South African Reserve Bank (SARB) database (www.reservebank.co.za).

2.3 Trade structure and performance outcomes

Trends in exports, imports and net exports from 1992 to 2005 are illustrated in Figure 2 below. As shown in the figure, there has been a substantial increase in exports and imports from 1992 to 2005. The aggregate response of trade to the opening up in the economy has been quite dramatic, reflecting the post apartheid reintegration. The slowdown in 1997-99 was probably related to the Asian crisis, but may also reflect the ending of the impetus provided by the ending of apartheid as observed by Davies and van Seventer (2003). The acceleration after 1999 reflects both world recovery and domestic liberalisation policies starting to make an impact (Davies and van Seventer 2003).

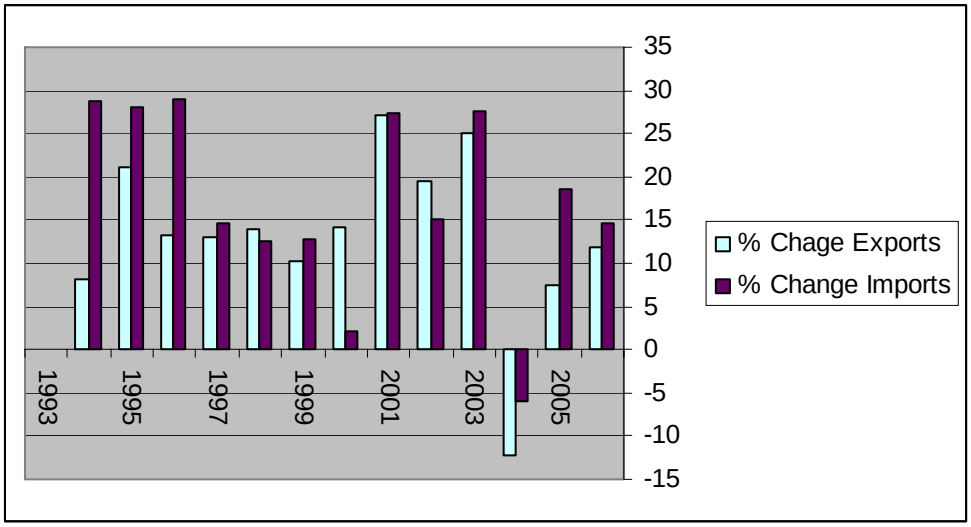
Figure 2: Trends in exports, imports and net exports from 1992-2005 (Rand millions)



Source: Calculations using data from The Department of Trade and Industry website (www.thedti.gov.za).

As shown in Figure 3, the increase in trade has been dominated by growth in imports. The balance of trade has turned negative from 2004. Exports are dominated by resources-based and relatively low value-added commodities while imports are primarily dominated by higher value-added goods. If one were to exclude gold merchandise exports, the top five export categories are precious and semi-precious stones and precious metals, mineral products, vehicles and other transport equipment, machinery and mechanical appliances and electrical equipment, and base metals and articles thereof. The top five import product categories comprise machinery and mechanical appliances, mineral products, chemicals, vehicles, and original motor vehicle components.

Figure 3: Trends in exports, imports and net exports from 1992-2005 (Rand millions)

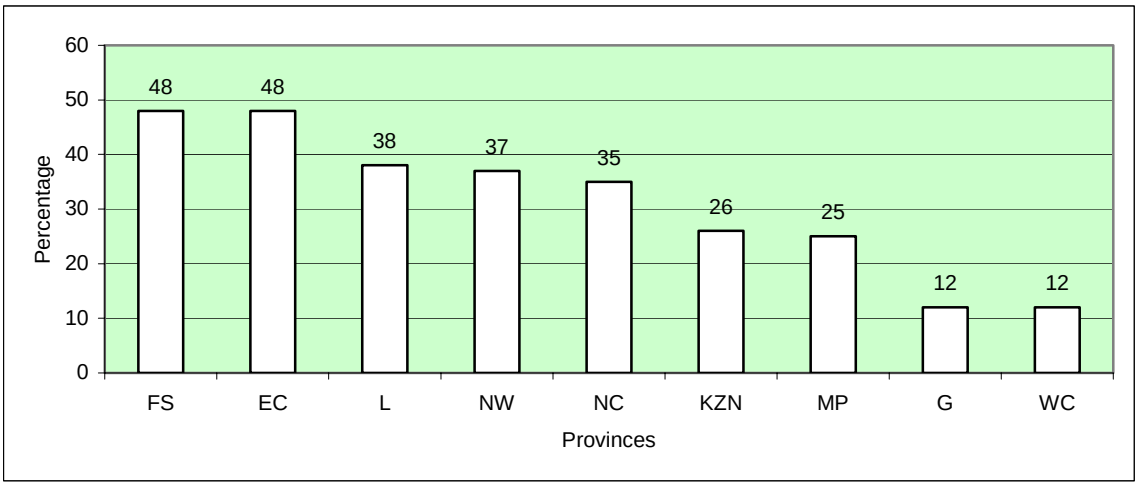


Source: Calculations using data from The Department of Trade and Industry website (www.thedti.gov.za).

2.4 Poverty and income distribution outcomes

According to the World Bank (1999), extreme poverty is concentrated mainly in rural areas where over 75 per cent of the households cannot meet the minimum food requirements. Using a poverty line of 1 US$ per capita per day, the study argues that urban poverty is much less acute, with only about 10 per cent of the households below the poverty line. The United Nations Development Program (UNDP) (2000) gives the rate of poverty as 45 percent. This is despite the fact that South Africa is classified as an upper middle- income country. Poverty differs greatly by region, race and employment status (Klassen and Woolard 1998). Although poverty is not confined to any one race group, it is concentrated among blacks, particularly Africans. 61 percent of Africans and 38 percent of coloureds are poor, compared with 5 percent of Indians and 1 percent of Whites. Poverty also runs along provincial lines, with those living in former homelands having a relatively larger share of the poverty as shown in Figure 4 (Gelb 2003). Poverty is distributed unevenly among the nine provinces. Provincial poverty rates are highest for the Eastern Cape (48 percent), Free State (48 percent), North-West (37 percent), Limpopo (38 percent), Northern Province (37 percent) and Mpumalanga (25 percent), and lowest for Gauteng (12 percent) and the Western Cape (12 percent)..

Figure 4: Incidence of poverty by province (Percent of households below poverty line)



Source: Stats SA 2000; Legend: Household poverty line based on monthly consumption expenditure of R800 or less in 1996 prices. Eastern Cape (EC),Free State (FS), Gauteng (G), KwaZulu-Natal (KZN),Limpopo (L), Mpumalanga (M), Northern Cape (NC),North West (NW),Northern Province (NP),Western Cape (WC).

The country's Gini coefficient remained at a consistently high level between 1975 and 1991, but within this was hidden changes occurring among races. Table 2 shows the changes in inequality in South Africa as a whole as well as the changes by population group and type of area using three inequality measures: the Gini Index,

mean log deviation, and the Theil Index. As shown in the table, the Gini coefficient for South Africa slightly increased from 0.56 to 0.58, indicating increasing income differentials. Mean log deviation went up from 0.56 to 0.61. The distribution between and among racial groups significantly worsened over the five-year period. There was a significant increase in inequality among the African population. Inequality also slightly increased among Coloreds and slightly decreased among Asians and Whites. In addition inequality slightly increased between the urban and rural areas.

<Table 1>: Changes in inequality between 1995 and 2000

		1995	2000
South Africa	Gini Index	0.565 (0.005)	0.577 (0.005)
	Mean Log Deviation	0.563 (0.011)	0.607 (0.012)
	Theil Index	0.608 (0.014)	0.617 (0.012)
Africans	Gini Index	0.467 (0.007)	0.501 (0.005)
	Mean Log Deviation	0.370 (0.011)	0.436 (0.010)
	Theil Index	0.414 (0.015)	0.460 (0.012)
Coloreds	Gini Index	0.439 (0.009)	0.453 (0.008)
	Mean Log Deviation	0.326 (0.014)	0.359 (0.012)
	Theil Index	0.345 (0.016)	0.348 (0.013)
Indians/Asians	Gini Index	0.398 (0.019)	0.374 (0.014)
	Mean Log Deviation	0.265 (0.025)	0.243 (0.021)
	Theil Index	0.287 (0.034)	0.233 (0.018)
Whites	Gini Index	0.344 (0.007)	0.319 (0.009)
	Mean Log Deviation	0.203 (0.008)	0.179 (0.011)
	Theil Index	0.201 (0.007)	0.172 (0.011)
Urban	Gini Index	0.527 (0.006)	0.533 (0.006)
	Mean Log Deviation	0.502 (0.013)	0.517 (0.013)
	Theil Index	0.494 (0.013)	0.502 (0.013)
Rural	Gini Index	0.493 (0.009)	0.502 (0.008)
	Mean Log Deviation	0.410 (0.016)	0.428 (0.014)
	Theil Index	0.513 (0.022)	0.516 (0.022)

Source: Hoogeveen and Özler (2004).

3. THE SEQUENTIAL DYNAMIC CGE MODEL FOR POVERTY ANALYSIS

3.1. The Model

This section presents the structure of the poverty focused sequential dynamic CGE model that is applied to South African data. This model is based on Annabi et al. (2005 a,b). The static part of the model follows from the EXTER model of Decaluwé et al (2001) which is discussed at length in the context of South Africa in Cockburn et al. (forthcoming). The full set of equations are available from the authors upon request.

Sequential dynamics is built into the EXTER model for a small open economy so that the dynamics do not influence world prices and interest rates. Early recursive dynamic CGE models include the work of Bchir et al. (2002), Bourguignon et al. (1989) as well as Jung and Thorbecke (2000). Taking into account South African CGE literature, the model's dynamic structure is similar to that proposed by Thurlow (2004). Arndt and Lewis (2001) develop a similar model structure to analyse the consequences of AIDS on the economy. Rattsø and Stokke (2005) analyse trade liberalization in an intertemporal dynamic Ramsey model and their growth specification is of direct relevance to our model.

The static part of the model broadly has a production and demand side interacting simultaneously. Overall output is modelled using a Leontief production structure. Value added in turn is a constant elasticity of substitution (CES) combination of labour and capital. Total capital demand is derived from cost minimization subject to the CES function. Labour is a CES aggregation of skilled and unskilled labour. The labour categorization is based on the following occupations:

(1) Skilled labour includes legislators, professionals, technicians;
(2) Semi-skilled labour includes clerks, service workers, skilled agricultural workers, craft workers, plant and machine operators; and
(3) Unskilled labour includes elementary occupations, domestic workers.

Semi skilled and unskilled labour are lumped together to form an unskilled aggregate. All labour categories are assumed mobile across sectors and wages are

crucial for income distribution. Capital, on the other hand, is sector-specific in the short run, implying rising supply curves on the real side but is allowed greater mobility in the long run when dynamics set in. As a result of this asymmetry, we would expect greater volatility in the rental capital return in the short run and broad convergence in the long run. The choice between domestic and imported inputs is specified as a CES function. On the demand side, households maximise Stone Geary type utility functions subject to their budget constraints, yielding linear expenditure system demands. The Armington assumption is used to model the choice between domestic and imported goods by households for final consumption. General equilibrium requires that the goods and factor markets are in equilibrium and the fundamental macroeconomic identity is satisfied. The goods market clears when demand and supply are equated via the material balance condition in each period. The fundamental macroeconomic identity requires the equality between investment and savings. The model has two broad options for revenue compensation in response to a trade liberalization that may reduce tariff revenue. The adjustments could be on the indirect tax rate or on the direct tax rate. Finally, the nominal exchange rate is chosen to be the numéraire for each period.

The static model is made sequential dynamic by a set of cumulation and updating rules from one year to the next. Growth in the total supply of labour is endogenous and is driven by an exogenous population growth rate. Since we lack data about the evolution of the labour participation rate in the future, we use the growth rate of population instead of the labour force and this implies that the labour participation rate is constant over time. It is also assumed that minimal consumption in the linear expenditure system grows according to the population growth rate.

Current period's investment augments the capital stock in the next period. Capital stock for each sector is updated by an accumulation function that equates next-period capital stock ($K_{i,t+1}$), to the depreciated capital stock of the current period and the current period's quantity of investment ($INV_{i,t}$) as follows:

$$K_{i,t+1} = (1-\delta)K_{i,t} + INV_{i,t}$$

A key question to resolve is how to allocate new investments between the different competing sectors. The literature suggests two approaches: using a capital

distribution function (see Abbink et al. (1995)) or using an investment demand equation. We opt for the investment demand approach that fits in well with the data that we have available on investment by destination. There are now a number of alternative specifications of the investment by destination functions in the literature (see for example Bchir et al. 2002). The most well known in dynamic CGE circles and one that we use in this work follows from the work of Bourguignon et al. (1989) and later elaborated on in Jung and Thorbecke (2000). It takes the following form:

$$\frac{INV_t^i}{K_t^i} = \kappa_{1i}\left(\frac{R_t^i}{U_t}\right)^2 + \kappa_{2i}\left(\frac{R_t^i}{U_t}\right)$$

where κ_{1i} and κ_{2i} are positive parameters calibrated on the basis of the investment elasticity and the investment equilibrium equation. The investment rate is increasing with respect to the ratio of the rate of physical return to capital (R_t^i) and its user cost (U_t). The user cost is the resulting dual price of investment multiplied by the sum of the depreciation rate and exogenous real interest rate. Investment by destination is used to satisfy the equality condition by being set equal to the investment by origin observations found in the benchmark data. It is also used to calibrate the sectoral capital stocks in the base run.

All other variables that are nominally indexed such as transfers are also subject to dynamic updating. The model is solved over a twenty-year time horizon and is checked to confirm that it is homogeneous of degree zero in prices and satisfies Walras Law.

To carry out poverty analysis, we follow the top down approach. This procedure involves first obtaining results summarizing the effects of trade liberalization from the sequential dynamic CGE model. In a second step, these results are fed into a micro simulation household model to obtain the predicted household effects. Data from the 2000 Household Income and Expenditure Survey of South Africa and Labour Force Survey were used (Statistics South Africa, 2001, 2002)[5]. The survey is nationally representative and has detailed information on

[5] It should be noted that there is an active literature discussing the merits and demerits of this household survey (see for example Simkins, 2003; Hoogeveen and Özler, 2004). The main criticism center on the perceived inadequacies of the sampling weights used, the lack of information required to impute comparable values on home produced goods and the lack of relevant quantities data to compute 'unit values' and price data to compute food prices at the community level. The latter two criticisms are largely irrelevant for this work since the CGE

household consumption patterns, income and household characteristics such as area, gender, number of persons and socio-economic characteristics. Non – parametric approaches are used based on the observed distribution of these households in the survey, their sample weights, number of individuals in the household and their independent characteristics of ethnicity, skill type and region. We have used the publicly available and efficient software called Distribution Analysis Software (DAD) for poverty analysis (Duclos et al. 2002). DAD allows us to compute many poverty descriptive indicators. The one that we are interested in for this particular study are the well known Foster Greer and Thorbecke (FGT) measures which can be summarised thus (see Foster et al. 1984):

$$P_{\alpha} = \frac{1}{Nz^{\alpha}} \sum_{j=1}^{J} \left(z - y_j \right)^{\alpha}$$

where j is a subgroup of individuals with consumption below the poverty line (z), N is the total sample size, y is expenditure of a particular individual j and α is a parameter for distinguishing between the alternative FGT indices[6].

3.2. The Data

To capture the base year structure of the South African economy, we have relied on a 2000 South African Social Accounting Matrix (SAM) that was developed by Thurlow and van Seventer (2002) under the auspices of the International Food Policy Research Institute (IFPRI). The original SAM includes 43 sectors, 14 household types, a government sector, enterprise and the rest of the world. The SAM has 4 factors of production, namely capital, unskilled, semi-skilled and skilled labour. In this study, an aggregated version of this SAM that includes 10 sectors, 3 factors of production (capital, skilled and unskilled labor) and 16 household types distinguished by region, skill and ethnicity is used. The latter is the main difference between the SAM used in this study and that of Thurlow and van Seventer (2002).

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model is used to generate price and quantities information while Simkins (2003) has demonstrated that the 2000 sampling weights are not as unreliable as first feared.

[6] When $\alpha = 0$ the expression simplifies to $\frac{J}{N}$, or the headcount ratio. This is a measure of the incidence of poverty. When $\alpha = 1$ the expression gives us poverty depth measured by the poverty gap. When $\alpha = 2$ the expression gives us the severity of poverty measured by the squared poverty gap.

The following are the 10 sectors used including their constituent parts:

1. Agriculture – comprising agriculture, fishing and forestry, referred to as AGRI
2. Mining – comprising gold, coal and other mining, referred to as MINI
3. Food – comprising food, beverages and tobacco, referred to as FOOD
4. Textiles – comprising textiles, apparel, leather and footwear, referred to as TEXT
5. Manufacturing – comprising paper products, printing, rubber, plastic, glass, non metal mineral products, iron, non ferrous metals, machinery, electric machinery, communication equipment, scientific equipment, other industries, wood, metal products and furniture, referred to as MANF
6. Petroleum, referred to as PETRO
7. Chemicals – comprising basic chemicals and other chemicals, referred to as CHEM
8. Vehicles – comprising vehicles and transport equipment, referred to as VEHI
9. Capital Goods – comprising electricity, water and construction, referred to as CONS
10. Services – comprising wholesale, trade, hotels and accommodation, transport services, communication, finance and insurance, business services, medical and other services, other producers and government services, referred to as SERV

According to Table 3, services is the largest sector in terms of value added, making up over 66 percent of value added, followed by manufacturing, mining and capital goods which together account for about 20 percent of value added. Unlike other sub-Saharan African countries, the share of the agriculture and food sectors in value added is very small, each contributing roughly 3 percent of value added. While the economywide tariff is relatively low at about 3.2 percent, this masks significant sectoral variation which highly distorts the trade regime. The highly protected sectors are textiles (11.9 percent), food (6.2 percent), vehicles (4.3 percent) and chemicals (3.6 percent). Agriculture is mildly protected, facing an average protection of 1 percent. The remaining sectors, notably mining, capital goods, petroleum and services are receiving little to no protection.

Mining is the most dominant sector on the trade scene, contributing about 34 percent of total exports. This is followed by manufacturing (26 percent) and then services (15 percent). An almost similar pattern is repeated by looking at export intensity. This measure shows that mining, manufacturing, petroleum and chemicals are very important intensive exporters of their output. Notice that these sectors are the most capital intensive in the economy. The relatively labour intensive sectors of textiles and services have small export intensities. With the exception of capital goods and services, the rest of the sectors face significant competition from foreigners for the domestic market.

<Table 3>: Initial sectoral shares

	Tariff	**Sectoral share in**			Import	Export	**Share in Value Added**		Sectoral	Sectoral
	rate	Value Added	Imports	Exports	Penetration	Intensity	Wages	Capital	Wage Share	Capital Share
Agriculture	0.70	3.16	1.60	2.71	6.39	11.37	1.07	2.09	2.10	4.27
Mining	0.01	6.49	10.20	33.44	49.48	78.08	3.09	3.40	6.05	6.95
Food	6.15	3.11	4.60	5.28	7.97	9.92	1.38	1.73	2.70	3.54
Textiles	11.87	1.05	3.51	2.16	17.00	12.25	0.81	0.24	1.59	0.49
Manufacturing	5.42	8.77	35.58	26.07	26.82	22.95	5.05	3.72	9.89	7.61
Petroleum	0.07	1.39	1.21	3.53	31.56	30.12	0.20	1.19	0.39	2.43
Chemicals	3.58	2.05	9.74	5.67	25.43	18.05	1.10	0.95	2.15	1.95
Vehicles	4.28	1.50	15.37	6.14	35.63	19.69	0.89	0.61	1.73	1.25
Capital Goods	0.00	5.53	0.47	0.53	0.90	1.13	2.63	2.90	5.14	5.93
Services	0.00	66.95	17.73	14.48	4.57	4.16	34.88	32.07	68.25	65.59
TOTAL	3.21	100.00	100.00	100.00	12.56	13.74	51.10	48.90	100.00	100.00

Source: Own computations based on constructed SAM 2000

The IFPRI SAM identifies 14 representative households according to their levels of income. Unlike the IFPRI SAM where households are identified according to income level (an endogenous variable in our model), in this paper households are defined taking into account exogenous characteristic of the representative groups such as rural-urban, ethnicity and skill level of the head of household. We have used the Income and Expenditure Survey (IES) of 2000 and the Labour Force Survey (LFS) of September 2000 to form the following 16 households:

UASK	Urban African Skilled Households
UCSK	Urban Coloured Skilled Households
UISK	Urban Indian Skilled Households
UWSK	Urban White Skilled Households
UAUSK	Urban African Unskilled Households
UCUSK	Urban Coloured Unskilled Households
UIUSK	Urban Indian Unskilled Households
UWUSK	Urban White Unskilled Households
RASK	Rural African Skilled Households
RCSK	Rural Coloured Skilled Households
RISK	Rural Indian Skilled Households
UWSK	Rural White Skilled Households
RAUSK	Rural African Unskilled Households
RCUSK	Rural Coloured Unskilled Households
RIUSK	Rural Indian Unskilled Households
RWUSK	Rural White Unskilled Households

Urban households spend disproportionately more of their income on services than rural households. It's important to recall that services have no nominal protection. On the other hand, rural households spend disproportionately more on primary agriculture commodities and foodstuffs than their urban counterparts. Both these commodities receive some amount of protection. When it comes to manufactured goods, we notice that urban households consume marginally more than rural households. Ethnicity also plays a role. Whites are the most important consumers of services, followed by Indians. Whites also consume disproportionately more of primary agriculture than other racial groups. Africans and Coloureds are by far the most important consumers of foodstuffs. Indians consume disproportionately more of the mining good than any other group while Whites consume significantly fewer textiles than other groups. Coloureds consume less manufactured goods than all other groups. These consumption patterns imply that changes in the consumer prices of these goods resulting from trade policy intervention have quite differential impacts on each household category depending on which goods experience price rises or falls.

The SAM data indicates the structure of the economy. However, we also need information on behavioural functions and this is typically captured from econometric estimates found in the literature. In our case, the Armington elasticities are obtained from the Industrial Development Corporation's general equilibrium model for South Africa (IDC, 2000). The estimation procedure used to arrive at these elasticities is discussed in IDC (2000). There were no econometric studies of export substitution elasticities and we have followed the suggestion in Thurlow (2004) to set these higher than Armington elasticities[7]. There are also no econometric estimates of commodity demand with respect to income that we could use, and hence we relied on those in Thurlow (2004). There is obviously a need for further econometric estimation of these elasticities and extended sensitivity analysis around the estimates.

A major hurdle that needed to be cleared involved what poverty line to use for the analysis. The choice was made difficult by the fact that there is no official poverty line for South Africa and different analysts use different poverty lines. Some researchers use the 'cost of basic needs' approach to draw normative poverty lines.

[7] The important implication of this is that producers are in general more able to shift output towards external markets than consumers are able to shift consumption patterns away from imported goods.

Using this approach, Hoogeveen and Özler (2004) argue that a reasonable poverty line for South Africa lies between R322 (lower bound poverty line) and R593 (upper bound poverty line) per capita per month in 2000 prices. There is also the internationally known US$2 per day poverty line that translates to R174 per capita per month. As pointed out in Hoogeveen and Özler (2004), this is very similar to the poverty line of R105 per capita per month in 1993 prices used by Deaton (1997). The 'dollar a day' poverty line is also another poverty line typically used. It translates to R87 per capita per month in 2000 prices. Table 4 reports computed poverty measures using these different poverty lines.

<Table 4>: FGT measures for different poverty lines in South Africa

	P0				**P1**				**P2**			
	1 US$p.d	**2US$p.d**	**R322/m**	**R593/m**	**1US$p.d**	**2US$p.d**	**R322/m**	**R593/m**	**1US$p.d**	**2US$p.d**	**R322/m**	**R593/m**
SA	9.2	29.6	52.6	70.4	2.8	11.2	25.6	42.6	1.3	5.7	15.4	29.8

Source: Own computations based on Income and Expenditure Survey 2000
Notes: P0, P1 and P2 are respectively poverty headcount, poverty gap and squared poverty gap. The first two poverty lines are on a per capita per day basis while the latter two are on a per capita per month basis.

In this study we make use of the 3864 South African rands per year as suggested by Hoogeveen and Özler (2004) and Cockburn et al (forthcoming). The poverty results are reported in Table 5.

<Table 5>: Poverty and inequality indexes (in percent)

	Initial Values in 2000		
	P0	P1	P2
South Africa	53	25.3	15
Residential Area			
Urban	42.4	18.4	10.2
Rural	68.3	35.4	22.1
Ethnic group			
African household	61	29.5	17.6
Coloured household	36.2	14.7	7.8
Indian household	6.4	2.3	0.8
White household	0.1	0	0
Region, Ethnic and skill group			
Urban African Skilled	0	0	0
Urban Coloured Skilled	0	0	0
Urban Indian Skilled	0	0	0
Urban White Skilled	0	0	0
Urban African Unskilled	17.9	10.08	5.5
Urban Coloured Unskilled	8.3	5.02	2.1
Urban Indian Unskilled	1.8	0.78	0.25
Urban White Unskilled	0.02	0	0
Rural African Skilled	0	0	0
Rural Coloured Skilled	0	0	0
Rural Indian Skilled	0	0	0
Rural White Skilled	0	0	0
Rural African Unskilled	43.6	15.4	11.2
Rural Coloured Unskilled	29.7	11.6	3.4
Rural Indian Unskilled	3.9	1.5	0.4
Rural White Unskilled	0.06	0	0

Legend: P0=Poverty headcount; P1= Poverty gap; and P2= Poverty severity

According to Table 5, 53 percent of South Africans were poor in 2000 according to the lower bound 'cost of basic needs approach' poverty line. The poverty gap was 25 percent while the poverty gap squared (severity) was 15 percent. Poverty headcount, its incidence and severity are more widespread in rural areas than in urban areas (see Table 5). It is clear that poverty affects mainly unskilled African and Coloured households where 61 and 36.2 percent respectively are classified as poor. Poverty is very low among Asian households and is even lower amongst White households at 0.1 percent. All skilled households are not poor. To understand the absence of poor individuals in the household headed by skilled workers, recall that skilled labour categories includes legislators, professionals and technicians. We use the SAM data to categorize households into income quintiles (E1) (that themselves are based on percentiles (P1-P12) as follows:

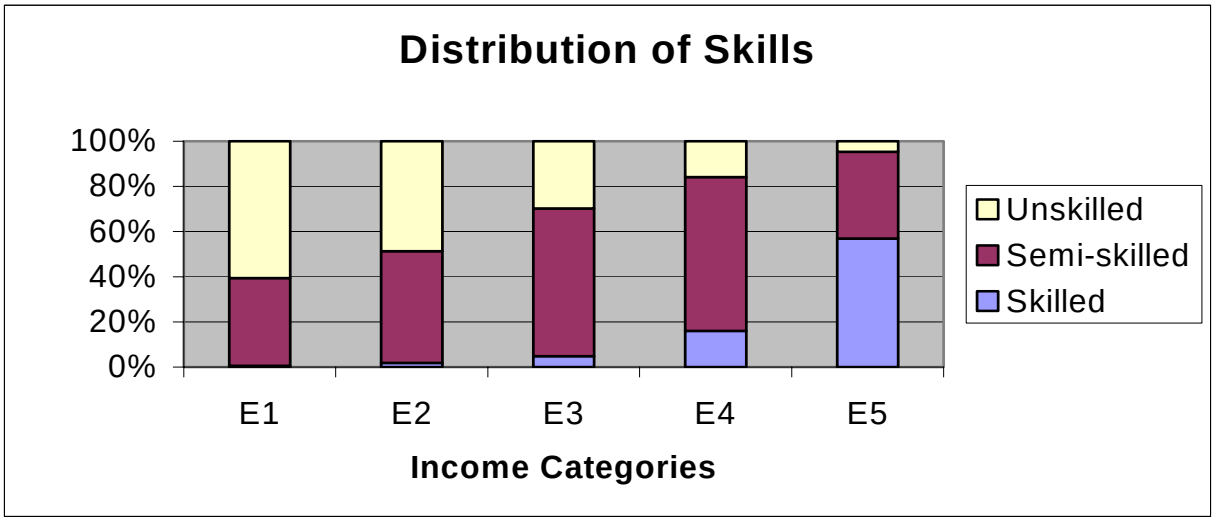
(1) E1 low (percentiles P1 and P2);

(2) E2 low middle (P3 to P5);
(3) E3 middle (P6 to P8);
(4) E4 high middle (P9 and P10); and
(5) E5 high (P11 and P12).

Figure 5 then to correlate skills with income levels. As would have been expected, the skilled employees contribute mostly at the medium and high income, and the unskilled to medium and low income levels. This largely explains the absence of poor individuals in the household headed by skilled workers as shown in Table 5.

Figure 5: Skills Distribution in the various Income Categories

Own computations based on constructed 2000 SAM



4. SIMULATION RESULTS

Trade liberalisation is simulated in this paper by a complete removal of all tariffs on imported goods and services, and by a combination of tariff removal and an increase of the total factor productivity. The two scenarios are described below in greater details.

Unilateral trade liberalization: The core simulation is a unilateral trade liberalization involving a complete removal of all import tariffs. This is assumed to take place from 2008 and the new tariff revenue is maintained until 2020.

Unilateral trade liberalization coupled with dynamic trade induced Total Factor Productivity (TFP) increases: This simulation is similar to the first one but includes TFP effects induced by trade liberalization commencing in 2008. The motivation for this simulation is as follows. The dynamic effects captured in the first simulation are due to more efficient allocation of capital and labour to sectors over time, as factor supplies grow, and caused by trade liberalization. In other words, it is the comparative static story of trade liberalization repeated year by year as factor supplies grow. This channel usually leads to very small impacts. New trade theory has moved beyond only looking at neoclassical market structures to consider phenomena such as increasing returns to scale, imperfect competition, technology transfers and dynamic links such as those between trade liberalization and total factor productivity (TFP)[8]. The model is extended so as to capture trade induced TFP increases. To incorporate this in the model, we model production to exhibit Hicks neutral technical change in the supply and value added equations. Under the hypothesis of trade induced technological improvements a growth of 3 percent (1 percent technological and 2 percent factor growth) from the year 2008 onwards is assumed and this is run together with the trade liberalization scenario described above.

In both simulations, the assumption made is that the government budget equilibrium is arranged by an endogenous uniform increase in indirect taxes through the Euler price equations. Alternative compensatory tax mechanisms – direct income tax, sales tax and value-added tax – could also be used. The fiscal policy aspects of the model are indeed a crucial aspect which is likely to have short and long term welfare effects although uniform compensation measures do not have strong distributional impacts. A long term trend of indirect compensation will impact household welfare as growth induces more revenues collection from other fiscal sources and less compensatory tax levy on products. An adjustment variable is introduced in the investment demand functions to handle savings-investment

[8] There is some literature in South Africa that points to the importance of openness and domestic factors in inducing TFP growth that is used to inform this study. Johnsson and Subramanian (2001), based on econometric evidence conclude that a one percentage point fall in nominal tariffs raises total factor productivity growth rate by 0.74 percentage points. They also find a role for machinery and equipment investment for TFP growth. In follow up work, Harding and Rattsø (2005) and Rattsø and Stokke (2005) emphasise adoption and innovation factors in explaining endogenous TFP in South Africa and offer and offer econometric evidence supporting this claim. Ferdekke and Vase (2001)'s work emphasises domestic factors in explaining TFP growth, highlighting a key role played by the ratio of skilled to unskilled labour for TFP growth. We explore, albeit in an ad hoc fashion, the likely influence of these trade induced TFP changes on growth and poverty in South Africa.

equilibrium. As pointed out in Annabi et al (2005), it is important to note that in dynamic analysis the economy is growing even without a shock. As a result, the relevant counterfactual to compare the results to is this 'business as usual' (BAU) growth path unlike in static CGE analysis where the relevant counterfactual is the base year SAM.

4.1. Unilateral trade liberalization

Macroeconomic effects

Table 6 below summarizes the macroeconomic effects of a full trade liberalization scenario without including dynamic trade induced productivity gains. Immediately we can see that trade liberalization has a very small effect on the macroeconomy, an observation that is consistent with the observation that South Africa already has very low import tariffs so that their removal will not have major impacts on the economy. Taking 2009 as the short run, Table 6 shows that trade liberalization increases GDP by only 0.02 percent in the short run and leads to small but positive increases in GDP over the rest of the policy period (2010-2020) due mainly to accumulation effects. The minor short run contraction in 2008 is explained by the contraction in previously highly protected sectors induced by increased import competition when the period is too short for capital to have relocated to the expanding export intensive sectors[9].

[9] Annabi et al (2005) find a similar effect in a study on Bangladesh.

<Table 6>: Macroeconomic effects of unilateral trade liberalization (percent change from BAU path)

	GDP PATH	CONSUMPTION	INVESTMENT	EXPORTS	IMPORTS	SKILLED WAGE	UNSKILLED WAGE	CONSUMER PRICE INDEX	CAPITAL GOOD PRICE	USER CAPITAL COST
2007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2008	-0.01	-1.75	0.67	2.74	2.87	-1.87	-1.80	-1.53	-2.61	-1.90
2009	0.02	-1.63	0.67	2.96	2.98	-1.76	-1.65	-1.46	-2.34	-1.84
2010	0.05	-1.53	0.69	3.14	3.08	-1.67	-1.53	-1.41	-2.06	-1.79
2011	0.07	-1.44	0.71	3.30	3.17	-1.58	-1.43	-1.36	-1.86	-1.76
2012	0.10	-1.37	0.73	3.44	3.25	-1.51	-1.33	-1.32	-1.72	-1.73
2013	0.12	-1.30	0.74	3.56	3.32	-1.45	-1.25	-1.28	-1.63	-1.70
2014	0.14	-1.24	0.74	3.66	3.37	-1.39	-1.17	-1.25	-1.57	-1.68
2015	0.17	-1.19	0.75	3.74	3.42	-1.33	-1.11	-1.23	-1.53	-1.66
2016	0.18	-1.14	0.75	3.82	3.46	-1.29	-1.05	-1.21	-1.52	-1.65
2017	0.20	-1.10	0.76	3.88	3.50	-1.25	-1.00	-1.20	-1.51	-1.64
2018	0.22	-1.07	0.76	3.93	3.53	-1.21	-0.96	-1.19	-1.51	-1.63
2019	0.23	-1.04	0.76	3.98	3.56	-1.18	-0.93	-1.18	-1.51	-1.62
2020	0.24	-1.02	0.75	4.01	3.58	-1.15	-0.90	-1.18	-1.51	-1.62

Both the rental and the user cost of capital decline in both the short and long run, but the rental return to user cost ratio increases in the long run. As a result, we notice that full trade liberalization leads to growth in investment by destination, with the long run response being stronger than the short run response. Similarly, the trade liberalization induced decline in domestic import prices leads to an increase in imports in the short and long run. The consumer price index also falls in the short and long run in response to reduced production costs made possible by lowering of tariffs. This, coupled with the ensuing decrease in domestic costs of production and the real exchange rate depreciation induces exports to increase in the short and long run. Exports grow more than imports in the long run. Because of the volume movement in exports and imports, sales on the domestic market fall. Both skilled and unskilled wages decline throughout the period following reduced demand for labour from the contracting labour intensive sectors. The short run contraction is more

severe than the long run contraction since in the long run capital will have reallocated to the more efficient sectors compared to the short run. As well, unskilled wage rates contract much less than skilled wages. In line with GDP developments, welfare as measured by the dynamic equivalent variation also falls initially in the short run but increases thereafter. These welfare changes are consistent with the fall in consumer price index being less than the fall in consumption in the short run while the fall in consumption in the long run is less than the fall in consumer price index. Based on the headcount ratio it can be concluded that poverty headcount is largely unaffected in the short run but declines in the long run. The amounts involved are very small.

Sectoral effects

Table 7 summarizes the main sectoral effects following a complete trade liberalization. The initial impact of the unilateral tariff removal is felt in import prices that fall for those sectors initially with positive levels of protection as shown in the Table. The fall in import prices is related directly to initial tariff protection, hence import prices fall the most in the textiles sector which has the highest initial protection, followed by food, manufacturing, vehicles, chemicals and agriculture. The import prices for the remaining sectors is virtually unchanged since their import duty is zero or very small. The reduction in domestic import prices and initial import penetration ratios for each sector are what explain the resulting sectoral import demands following unilateral trade liberalization (see Table 7). Imports rise the most for textiles, followed by food, manufacturing, vehicles and chemical products. The increase is higher in the long run compared to the short run. These sectors have relatively higher initial tariff protection and import penetration. Imports remain virtually unchanged or fall slightly both in the short run and in the long run for the other sectors, most notably for agriculture, petroleum, services, capital goods and mining. The sectors in which imports fall are also the ones with the lowest initial tariff protection as consumers substitute towards other goods which have experienced relative cheapening following trade liberalization.

The increase in imports results in a depreciating exchange rate. With world export prices given by the small country assumption, the exchange rate depreciation

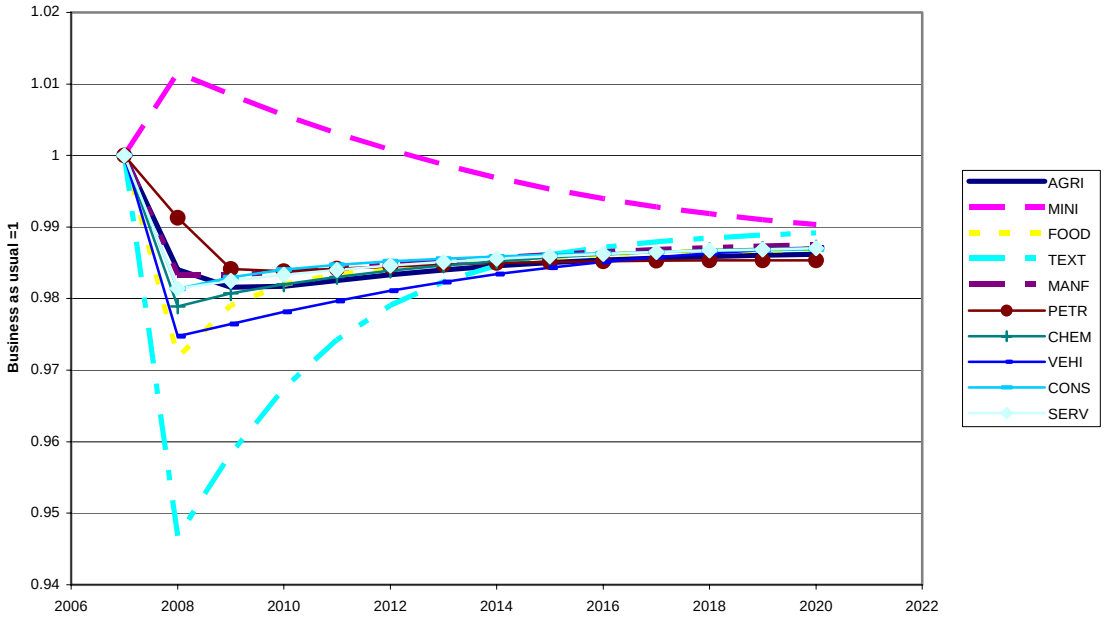
leads to increases in domestic export prices which induce export volumes to increase. As can be observed in Table 7, exports go up both in the short run and in the long run for all sectors except textiles. They go up most dramatically in the mining sector given its initial higher export intensity (78 percent) compared to other sectors. With the exception of mining and petroleum, the long run growth of exports is lower than that in the short run. But interestingly, exports fall even more in the long run for the textiles sector, despite the fact that this is the sector with initially the highest protection levels. This result is due to a combination of falling production induced by dwindling domestic demand as well as the negative effect of domestic indirect tax adjustment which falls disproportionately more on this sector. Thus, the increased competition has reduced output and export for textiles.

<Table 7>: Sectoral effects of unilateral trade liberalization (BAU =1)

	Import Price		**Imports**		**Exports**		**Skilled Labour**		**Unskilled La**	
	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Lo
AGRI	0.9931	0.9931	0.9810	0.9856	1.0323	1.0247	1.0024	0.9984	1.0018	0
MINI	0.9999	0.9999	0.9975	0.9870	1.0176	1.0909	1.0328	1.0700	1.0321	1
FOOD	0.9420	0.9420	1.0586	1.0706	1.0288	1.0146	0.9902	0.9946	0.9896	0
TEXT	0.8939	0.8939	1.3050	1.3684	0.9869	0.9438	0.9169	0.9206	0.9164	0
MANF	0.9486	0.9486	1.0316	1.0361	1.0337	1.0281	1.0024	1.0005	1.0018	0
PETR	0.9993	0.9993	0.9871	0.9827	1.0148	1.0298	1.0070	1.0047	1.0064	1
CHEM	0.9654	0.9654	1.0173	1.0244	1.0298	1.0197	0.9970	0.9961	0.9964	0
VEHI	0.9589	0.9589	1.0368	1.0527	1.0432	1.0152	0.9910	0.9789	0.9904	0
CONS	1.0000	1.0000	0.9910	0.9949	1.0340	1.0301	1.0000	1.0017	0.9994	0
SERV	1.0000	1.0000	0.9869	0.9910	1.0351	1.0251	1.0000	0.9997	0.9994	0

The developments in value added prices, factor remunerations and input costs to a large extent influence the reallocation (static efficiency) and accumulation (dynamic) effects of trade liberalization. Figure 6 shows the evolution of value added prices. Value added prices increase in the short run for mining, which receives the greatest positive stimulus from the trade induced real exchange rate depreciation. All other sectors experience declining value added prices in the short run. All sectors experience declining prices in the long run, but with mining being the least affected.

Figure 6: Evolution of the price of value added in response to trade liberalization



The variations in the value added price influence the movement of the wage rates and the capital rental rate and these in turn trigger factor reallocations. Wages fall for both skilled and unskilled labour in both the short and long run. The fall in wages can be traced directly to a fall in labour demand as a result of the contraction in labour demand of the labour intensive sectors of services, textiles and chemicals. The expanding mining sector is relatively capital intensive, which explains why its capital rate of return increases. As can be gleaned from Table 7, both skilled and unskilled labour relocates towards the expanding mining sector and to a limited extent towards agriculture, manufacturing and petroleum. Capital goods also attract skilled labour both in the short and long run. The declining sectors, especially textiles, chemical goods, vehicles and to a minor extent services are generally shedding labour.

Capital stock movements reinforce the effects on output from labour reallocation and accumulation. As shown in Table 7, the rate of return on capital initially increases in the short run and subsequently declines in the long run for the capital intensive mining, in line with value added price developments discussed earlier. There is a pronounced initial decline in capital return for textiles as well as the other initially highly protected sectors (food, manufacturing and chemicals). The short run volatility in capital returns are to be explained by the observation that capital is given and sector specific. However, in the long run the rates tend to converge as

capital has had sufficient time to reallocate to the most profitable sectors (this is why the short run positive return in mining falls in the long run). Relatively speaking, we notice that mining has become relatively more profitable than other sectors especially in the short run following trade liberalization.

As shown in Table 7, the consequences of these capital price developments are that capital reallocates towards mining and its accumulation is also the highest in this sector. Accumulation remains negative both in the short and long run for the now relatively unprofitable sectors of food, textiles, chemical and vehicles. The sharpest declines are in textiles, especially in the long run following from the massive relative fall in the capital rate of return. The resulting impacts on output of these value added price dynamics and factor reallocations are that resources will move away from other sectors, especially textiles, towards the mining sector. As expected, trade liberalization leads to reductions in domestic sales. Looking at sectoral domestic sales development gives us an idea of which sectors are driven out of the market by the increased import competition. It turns out that the only winner in terms of domestic market capture in the short run is mining. All other sectors experience losses in their shares of the domestic market. The worst affected is textiles followed by vehicles, chemicals, manufacturing, food and agriculture.

The intuition behind this result is that the tariff reduction following an across the board tariff removal induces a drop of government revenue (these products represent little more than 8 percent of indirect tax revenue). Government loss of revenue is compensated by an increase of domestic indirect taxes. Food, textiles, vehicles and chemicals show the highest domestic tax rates so that the tax increase affects mostly these sectors and particularly textiles. There is a drop of these sectors domestic demand, over and above the drop induced by increased import pressure. Inter industry flows are then responsible for transmitting these negative flows to other sectors with the exception of mining which remains insulated as it does not have strong linkages with the rest of the economy. Mining gains even more of the domestic market share in the long run, but this time a number of other sectors regains their domestic market shares. These are petroleum and capital goods, all of them relatively capital intensive sectors. The rest of the sectors suffer losses. The changes in domestic market shares are relatively small compared to the changes in exports and imports because of the relatively small initial import intensities as well as the imperfect substitution between local and imported sales which both have the tendency to limit further import substitution of domestic production.

The changes in domestic sales have an impact on domestic prices and consequently gross supply. Table 7 shows that output goes up dramatically in mining both in the short and long run, driven by the surge in exports from the real exchange rate depreciation which is further reinforced by the positive domestic sales effect. There are also very minor gains for agriculture, manufacturing and petroleum in the short run as a result of cheaper inputs as well as positive export incentives. In the long run, mining receives the highest expansion in gross supply while petroleum, manufacturing, capital goods and services also continue to experience positive supply responses. The remaining sectors experience declining fortunes, with the most severely affected being textiles, followed by vehicles, food and chemicals.

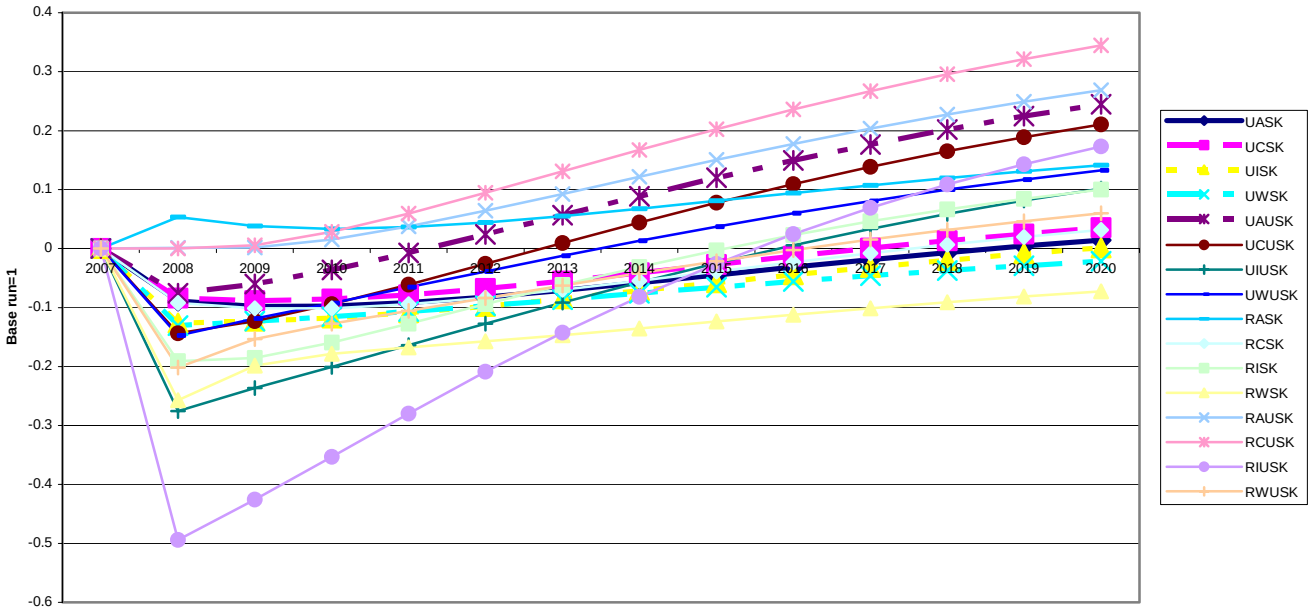
As would be expected from the movements in capital rates of return and capital accumulation discussed above as well as the observation that falling import prices also reduce the cost of imported investment, Table 7 shows that investment by destination goes up both in the short run and the long run for mining, agriculture, manufacturing, petroleum and capital goods. The biggest increases are in the mining sector. Services experiences increases in investment only in the long run. The main reason for this is that relatively speaking, the average return to capital relative to the user cost of capital goes up in these sectors. There is a pronounced fall in the short run for textiles, followed by gradual declines in food, chemicals, food and vehicles as the average return to capital relative to the user cost of capital falls in the short run relative to other sectors. However, investment by destination falls by less in these sectors due to a relative cheapening over time in these goods.

Welfare effects

Because factor prices are the main drivers of household income, we would generally expect household incomes to fall, with the fall determined by initial factor shares. Household income falls both in the short and long run following full trade liberalization for all households. However, rural skilled households tend to experience smaller declines in income than other groups. This is because they depend disproportionately less on employment in the declining textiles sector. Total real household consumption follows the same trend as household incomes, declining for all households both in the short and long run. As shown in Figure 7, welfare as measured by the dynamic equivalent variation falls for most households in the short

run because income declines more than the consumer price index for most households. Rural African households and Urban Coloured Unskilled households experience positive welfare effects in the short run as their income fall by less than the fall in the consumer price index. In the long run, with the exception of skilled White households, changes in income and consumer price index move in such a way that households experience welfare increases. Coloured and African unskilled households are the main beneficiaries, irrespective of their regional location.

Figure 7: Evolution of equivalent variation following a trade liberalization



Poverty effects

The impact of trade liberalization on poverty is captured by changes in the poverty indices reported in the last column of Table 8. The changes in poverty are largely in line with the changes in welfare. This is because the changes are largely driven by changes in the consumer price index and changes in household income or consumption. The impacts on poverty are very small. Using the percent change in average headcount index of poverty measure, the results in Table 8 suggest that a unilateral removal of tariffs has a very small but negative impact on poverty headcount. The burden of these negative impacts is shared almost evenly between urban and rural households. Indian unskilled households, in particular rural Indian households, shoulder a disproportionate amount of the poverty burden. This is largely because of their higher dependence on employment in textiles, the sector that

faced the highest protection before the trade policy intervention. The average poverty gap and the squared poverty gap also follow a similar pattern.

<Table 8>: Impact of trade liberalization on poverty (in percent of BAU)

	Short Run =2009			Long Run =2020		
	P0	*P1*	*P2*	*P0*	*P1*	*P2*
South Africa	0	0.55	0.83	-0.19	-2.15	-2.65
Residential Area						
Urban	0.0014	0.17	0.29	-0.01	-1.58	-1.98
Rural	0.0013	0.2	0.38	-0.52	-4.41	-4.65
Ethnic group						
African household	0.009	0.12	0.19	-1.1	-1.3	-1.66
Coloured household	0.001	0.25	0.26	-5.2	-5.54	-6.1
Indian household	0.026	0.19	0.43	-0.6	-1.82	-1.97
White household	0.01	0.15	0.33	0	0	0
Region, Ethnic and skill group						
Urban African Skilled	0	0	0			
Urban Coloured Skilled	0	0	0			
Urban Indian Skilled	0	0	0			
Urban White Skilled	0	0	0			
Urban African Unskilled	0.007	0.22	0.45	-1.43	-1.44	-1.78
Urban Coloured Unskilled	0.001	0.54	0.84	-1.27	-2.35	-2.98
Urban Indian Unskilled	0.03	0.55	0.65	-0.2	-0.67	-0.85
Urban White Unskilled	0	0	0			
Rural African Skilled	0	0	0			
Rural Coloured Skilled	0	0	0			
Rural Indian Skilled	0	0	0			
Rural White Skilled	0	0	0			
Rural African Unskilled	0	0	0	-1.34	-3.59	-3.92
Rural Coloured Unskilled	0	0	0	-1.4	-6.22	-7.05
Rural Indian Unskilled	0.0031	0.72	0.78	0	0	0
Rural White Unskilled	0.006	0	0	0	0	0

The picture reverses in the long run, with the incidence of poverty declining for the whole country by about 0.19 percent, which is still quite small. The reduction in poverty is as a result of the static and dynamic efficiency gains from trade liberalization as well as accumulation effects. The main beneficiaries of reduced poverty are Coloured households, followed by African households. Both supply a higher proportion of their labour endowment to the mining sector and other tradeable sectors. They also consume disproportionately more foodstuffs whose cost has been reduced by trade liberalization. Indian households also experience reductions in poverty, but by a relatively smaller margin. Rural households benefit more than urban households, given their higher dependence on the booming mining sector.

4.2. Unilateral trade liberalization with TFP increases

As argued above, the impacts of trade liberalization on the economy have tended to be very small, even after allowing for dynamic effects emanating from factor accumulations through time. One rationalization used for this result was that the country has already reaped the gains from trade given that the country has undergone substantial trade liberalization since 1994. In line with modern trade literature, we wish to explore in this section whether dynamic trade induced TFP changes may lead to “bigger numbers” from trade liberalization.

Macroeconomic effects

According to Table 9, removing all tariffs under the assumption of trade induced TFP increases has very pronounced and beneficial effects compared to trade liberalization without productivity gains. We see that factoring TFP gains will raise GDP from about 1 percent in 2009 to over 6 percent in 2020. This in turn will positively impact on incomes, which in turn raises savings and consequently investment. Private consumption rises sharply compared to the no TFP change scenario. The increase in GDP feeds into increased consumption both in the short and long run. The capital good price rises in the short run before falling in the long run. However, because of TFP increases, the user cost of capital falls from 2009 until 2020. Because of the rising rental to user cost of capital ratio couple with the higher induced savings, there is a boom in investment by destination, with the long run response being stronger than the short run response. Imports increase dramatically not only due to the cost reducing effects of tariff cuts but also because TFP induced growing economy requires a higher level of imports to meet higher production levels and increased household demands. Indeed imports rise much faster than exports in the short run, in part due to an induced real exchange rate appreciation. In the long run, exports grow more than imports. The consumer price index increases initially in the short run before declining in the long run. Skilled and unskilled wages increase in both periods following increased demand for labour to meet higher growth needs.

Welfare rises dramatically in line with the observed consumer price index and consumption developments. Finally, trade induced TFP increases and accumulation effects lead to reductions in poverty, both in the short and long run.

<Table 9>: Macroeconomic effects of a unilateral trade liberalization and TFP improvements (percent change from BAU path)

	GDP PATH	CONSUMPTION	INVESTMENT	EXPORTS	IMPORTS	SKILLED WAGE	UNSKILLED WAGE	CONSUMER PRICE INDEX	CAPITAL GOOD PRICE	USER CAPITAL COST
2008	-0.06	8.52	17.50	3.36	10.32	7.87	8.65	0.35	12.94	1.27
2009	0.91	9.34	18.86	4.63	11.03	9.41	9.98	0.15	7.93	-0.93
2010	1.88	10.29	18.96	6.14	11.62	10.94	11.48	-0.17	5.60	-1.87
2011	2.76	11.17	18.57	7.63	12.07	12.31	12.85	-0.50	3.93	-2.43
2012	3.53	11.93	17.99	9.00	12.40	13.49	14.06	-0.79	2.55	-2.79
2013	4.18	12.58	17.36	10.22	12.66	14.49	15.09	-1.02	1.37	-3.03
2014	4.72	13.12	16.74	11.26	12.85	15.32	15.94	-1.20	0.38	-3.18
2015	5.16	13.55	16.16	12.14	12.98	16.00	16.64	-1.34	-0.44	-3.28
2016	5.51	13.90	15.63	12.87	13.08	16.53	17.19	-1.44	-1.11	-3.33
2017	5.78	14.17	15.15	13.46	13.15	16.94	17.61	-1.51	-1.66	-3.36
2018	5.99	14.37	14.72	13.93	13.18	17.24	17.93	-1.56	-2.09	-3.37
2019	6.15	14.51	14.34	14.30	13.20	17.46	18.16	-1.59	-2.43	-3.36
2020	6.26	14.60	14.00	14.58	13.19	17.61	18.31	-1.60	-2.70	-3.34

Sectoral effects

Obviously the fall in import prices as a result of tariff removal with TFP increases will not differ from that induced by tariff removal in the absence of induced TFP increases. However, the overall impact on import levels will differ because of the increase in import demand induced by TFP growth. Thus, from Table 10 we notice that imports are higher in the trade induced TFP increase tariff reduction scenario than the same scenario without productivity gains. The sectoral distribution of these TFP induced higher imports is similar to the case without TFP increases and driven by changes in import prices as before.

The trade induced TFP increase results in an increase in exports in all sectors both in the short and long run (see Table 10) which is higher than when there was no

trade induced TFP increases. While mining was responsible for most of the export growth in the previous scenarios, export growth is now driven by Vehicles, Manufacturing and Food. This is because they have larger linkages with the domestic economy which is growing than the Mining sector has, hence they benefit more from a growing economy.

<Table 10>: Sectoral effects of unilateral trade liberalization with TFP growth (BAU =1)

	Imports		**Exports**		**Skilled Labour**		**Unskilled Labour**		**Capital Dem**	
	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Lo
AGRI	1.0699	1.0998	1.0063	1.2039	1.0126	1.0291	1.0061	1.0236	1.0190	1
MINI	1.0180	1.0875	1.0153	1.0890	0.9747	0.9990	0.9684	0.9937	1.0033	1
FOOD	1.1825	1.2201	1.0397	1.2609	1.0799	1.0767	1.0729	1.0709	1.0487	1
TEXT	1.4330	1.5762	1.0409	1.1008	0.9658	1.0125	0.9596	1.0071	1.0004	1
MANF	1.1212	1.1345	1.0528	1.1624	1.0467	1.0276	1.0399	1.0222	1.0360	1
PETR	1.0333	1.0492	1.0302	1.2114	1.0124	0.9947	1.0059	0.9894	1.0195	1
CHEM	1.0538	1.1198	1.0572	1.1831	1.0022	1.0337	0.9958	1.0282	1.0146	1
VEHI	1.1384	1.1038	1.1146	1.2931	1.0786	1.0980	1.0717	1.0921	1.0519	1
CONS	1.1083	1.1019	0.9594	1.1667	1.1152	1.0140	1.1080	1.0086	1.0771	1
SERV	1.0310	1.0880	0.9938	1.0555	0.9851	0.9903	0.9787	0.9850	1.0078	1

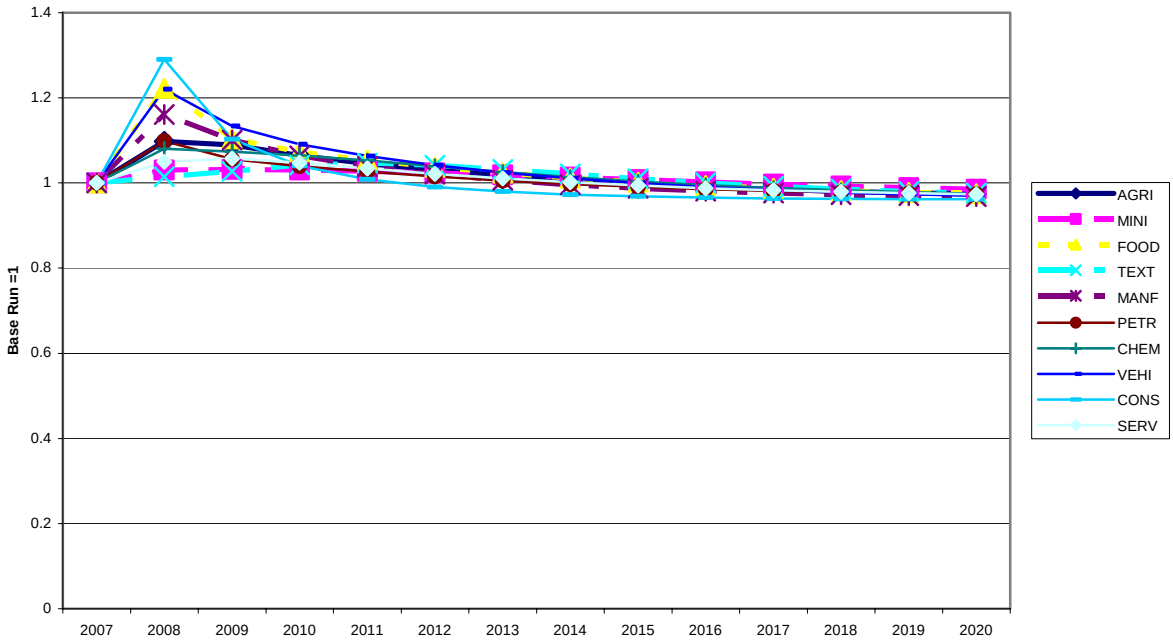
While the only sector that gained in terms of domestic sales in the tariff reduction scenario without TFP increases was Mining, we notice from Table 9 that all sectors now experience increased domestic demand in the trade liberalization induced TFP gain scenario induced by higher growth in the long run. Viewed from the context of the earlier scenario, the sector that gains the most is textiles. This is because textiles has the highest initial factor scale parameter associated with it.

The effect on gross supply follows a similar trend as the outcome in domestic demand that has just been discussed (see Table 10). All sectors benefit from trade induced TFP increases. Sectors such as Food, Vehicles, Construction and Agriculture with higher scale parameters gain the most. Services benefits from the high growth scenario because its output is an important input for most of the sectors which are experiencing gains. Mining, the sector that benefited the most in the case without trade induced TFP growth does not benefit as much, although it still experiences positive impacts. This is because of a lower factor scale parameter associated with its production functions as well as lower linkages with the rest of the economy.

On the factor markets, wages increase for both skilled and unskilled workers in the short and long run in response to increased labour demand as a result of the expanding economy (Table 10). Unskilled wage rates rise slightly more than skilled wage rates. Labour is now being drawn from mining sectors towards the other sectors, a complete reversal of what was observed in the scenario with no trade induced TFP increases. Overall, employment increases for all skill categories although skilled labour experiences marginally higher growth.

Together with increases in value added prices and wage rates, the return on capital increases for all sectors in the short run in all the sectors and subsequently declines for all sectors in the long run (Figure 8). However, the decline in the long run is relatively less than the decline in the user cost of capital. As a result, investment by origin increases in both the short and long run following a trade induced TFP increase (Table 10).

Figure 8: Evolution of capital return following trade liberalization and TFP increases



Due to higher induced savings and the movements in capital rates of return and capital accumulation discussed above, trade induced TFP growth increases investment by destination for all sectors (Table 10). The increases are higher in the

short run than in the long run. Construction receives the highest positive stimulus to investment in the short run while in the long run capital accumulation is more evenly spread. Compared to the no TFP change trade liberalization scenario, we notice several important differences. The sharp short run decline in textiles investment observed in the no TFP increase scenario is now absent while the Mining sector has moved from being the sector that benefits the most from investment to one that receives the least gains. In the long run, investment has gone up roughly by an average of 14 percent for each sector compared to the business as usual path whereas it only went up by a mere 0.75 percent in the no TFP increase trade liberalization scenario.

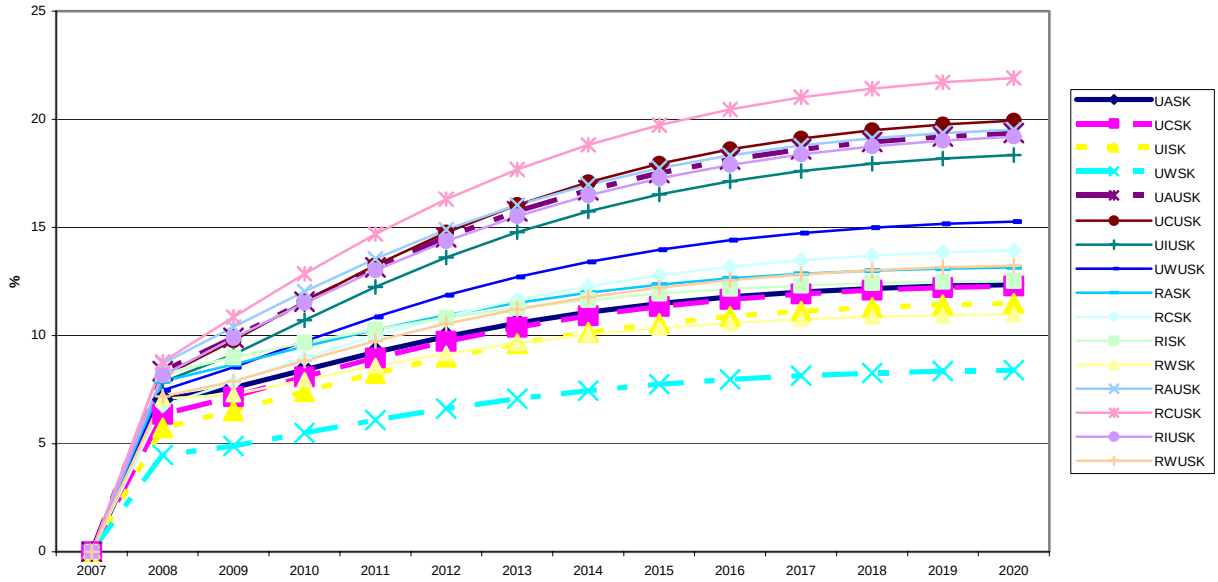
Welfare effects

We have observed that a main consequence of trade induced TFP growth is the increase in factor prices. Given that factor prices are the main driving force behind household income, it is not surprising that the trade induced TFP intervention results in all household incomes increasing. The gain is higher in the long run compared to the short run and much higher than was the case in the no TFP increase trade liberalization scenario. African, Indian and Coloured Unskilled households reap most of the benefits while Rural White households benefit the list[10].

The increase in household income is higher than the increase in consumer price index in the short run so that real consumption and welfare increases for all households (Figure 9). In the long run, the falling consumer price index reinforces the income effects so that the equivalent variation goes up by even more for all households. Total household consumption follows the same trend as household incomes, increasing for all households both in the short run and in the long run. Unskilled households gain more than skilled households while rural households stand to gain more than urban households.

[10] We should not make much from this observation given the small size in the sample of this group.

Figure 9: Evolution of welfare following trade liberalization and TFP increases



Poverty effects

Trade induced TFP increase has a more significant impact on poverty reduction than trade liberalization without induced TFP growth as shown in Table 11. The poverty headcount ratio falls by 0.54 percent in the short run and by 5.34 percent in the long run. Most of the poverty reduction is felt amongst African and Coloured households while urban households benefit less than their rural counterparts from the ensuing fall in poverty. Once again the average poverty gap and the squared poverty gap also follow a similar pattern to the headcount ratio.

<Table 11>: Impact of trade liberalization on poverty (in percent of BAU)

	Short Run =2009			Long Run =2020		
	P0	*P1*	*P2*	*P0*	*P1*	*P2*
South Africa	-0.54	-0.20	-1.30	-5.34	-4.30	-7.78
Residential Area						
Urban	-0.33	-0.15	-1.67	-5.22	-5.16	-6.45
Rural	-0.56	-0.46	-1.34	-7.46	-6.60	-8.30
Ethnic group						
African household	-1.15	-1.30	-2.20	-6.44	-5.42	-7.70
Coloured household	-1.31	-0.78	-1.80	-7.92	-7.20	-8.20
Indian household	-0.50	-0.10	-1.45	-5.77	-4.32	-7.20
White household	-0.21	-0.10	-1.78	-4.25	-3.21	-5.40
Region, Ethnic and skill group						
Urban African Skilled	0.00	0.00	0.00	0.00	0.00	0.00
Urban Coloured Skilled	0.00	0.00	0.00	0.00	0.00	0.00
Urban Indian Skilled	0.00	0.00	0.00	0.00	0.00	0.00
Urban White Skilled	0.00	0.00	0.00	0.00	0.00	0.00
Urban African Unskilled	-0.70	-0.40	-1.45	-9.36	-11.40	-12.30
Urban Coloured Unskilled	-1.20	-0.54	-1.84	-9.90	-12.80	-16.60
Urban Indian Unskilled	-0.12	-0.55	-1.65	-2.30	-3.80	-5.60
Urban White Unskilled	-0.13	-1.62	-1.92	-1.34	-3.30	-8.80
Rural African Skilled	0.00	0.00	0.00	0.00	0.00	0.00
Rural Coloured Skilled	0.00	0.00	0.00	0.00	0.00	0.00
Rural Indian Skilled	0.00	0.00	0.00	0.00	0.00	0.00
Rural White Skilled	0.00	0.00	0.00	0.00	0.00	0.00
Rural African Unskilled	-1.40	-1.30	-1.93	-10.52	-9.98	-11.20
Rural Coloured Unskilled	-1.86	-2.30	-2.23	-10.91	-8.87	-12.15
Rural Indian Unskilled	-0.87	-0.72	-1.78	-4.19	-2.40	-6.40
Rural White Unskilled	-0.67	-0.57	-1.83	-3.23	-3.2	-5.6

5. Summary and conclusion

South Africa has undergone significant trade liberalization since the end of apartheid. Average protection has fallen while openness has increased. The macroeconomic performance in this era of liberalizing trade has been unimpressive, with GDP growing by insufficient amounts to make inroads into the high unemployment levels. Poverty levels have also risen. This paper examines the impact of unilateral trade policy reforms on the economy with and without trade induced TFP increases. The study advances existing CGE work in South Africa in at least two ways. Firstly, it uses a top down approach based on the 2000 household survey to model explicitly poverty effects of policy. Secondly, it employs a sequential dynamic CGE model to carry out the sequential “top down” poverty micro simulation.

Trade liberalization alone has very minimal short run macroeconomic consequences. The outcome for the long run macroeconomic developments is

positive for tariff removal although the magnitude of the impacts is still very small. The sectoral results indicate that sectors which initially faced high protection levels tend to be the ones to lose out disproportionately more from trade liberalization. The biggest winner is Mining while the biggest loser is Textiles. The picture reverses when we allow for trade induced TFP increases, with bigger and positive impacts on the macroeconomy. Mining is no longer the main beneficiary of the reform.

The welfare outcomes are initially negative in the short run but turn positive if we allow for trade induced TFP increases. The welfare gains are positive in the long term in all scenarios. Although all households benefit in the long run, African and Coloured poor households in general and especially those residing in rural areas reap the most benefits. Trade liberalization policy has been found to be progressive – highest gains accrue to the poorest groups – despite the low level of tariff protection remaining in South Africa.

In terms of poverty, trade liberalization has no appreciable impact on poverty in the short run even if we allow for trade induced TFP increases. However, in the long run poverty reduces even in the case when we do not allow for TFP increases. Again, African and Coloured households gain the most in the long run in terms of numbers being pulled out of absolute poverty, especially if the trade measure were to induce TFP increases.

Some useful policy conclusions emerge from these results. Without exception, there is still substantial scope to lower prices and raise household welfare through stronger unilateral tariff liberalization. However, there is an asymmetry in the timing of the welfare gains that can only be picked by dynamic analysis. If trade liberalization induces TFP increases, the gains are magnified. These results point to a future role for trade policy in South Africa. They suggest that short-term temporary measures such as transfers to poor households may be justified to ameliorate the transitory negative effects on the poor before the long-term gains are realized. They also suggest that measures should be put in place so as to increase the chances that future tariff cuts generate substantial TFP growth. Such measures could include training programs.

When interpreting and using these results, it is important to be aware of a number of limitations inherent in the approach that is used which remain areas for

future research. First, it is important to understand the consequences of hypothesis used in updating capital, labour and minimum consumption and how that complicates distributional outcomes. For instance, saving/investment behaviours may not be identical for all households and this will have strong income distribution and welfare impacts in subsequent years. A related limitation of the model used is that it does not make a distinction between the growth rate in skilled and unskilled labor, which may be unrealistic in an economy displaying high unskilled labour unemployment. The assumption used of identical population growth for all households needs to be interrogated further as this will impact on their consumption and saving behaviour as the minimum consumption is updated. Government expenditure will also need to be adjusted according to the increase of public services and investment demand from the growing population. Finally, analysis of growth and distribution effects on poverty will be another fruitful area for further research.

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